1679

THE AGRICULTURAL LEDGER.

1906—No. 2.

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THE

AGRICULTURAL LEDGER.

1906—No. 2.

COSTUS SPECIOSUS.

[*Dictionary of Economic Products, Vol. II.*, C. 579-581.]

The uses and value of the root of Costus speciosus *as a food stuff.*

By DAVID HOOPER, F.I.C., F.C.S.

Costus speciosus, *Smith; Hooker fil., Flora of British India, VI., (1892), page 249; Watt, Dictionary of Economic Products, II., (1889), pages 579-581, paragraphs C, 2013-2018; Dymock, Warden and Hooper, Pharmacographia Indica, III. (1893), page 427.*

Syn.—COSTUS ANGUSTIFOLIUS, *Ker-Gawl;* C. ARABICUS, *Linn.;* C. ARGYROPHYLLUS, *Wall.;* C. SERICEUS, *Bl.*

Vern.—*Gód, chirayagód, bilaya kand,* SASARAM; *Kewa,* PALAMAU; *Kia kandia,* PURI; *Orop,* SANTALI; *Keu,* BENGALI; *Keoli, kyóla, koot,* U. P., *Kes-kand, keoo kanda,* RAIPUR; *Kai kanda,* SAMBALPUR; *Baesie godda,* CHANDA, C. P.; *Bomma kachika,* TELEGU; *Penva,* MAR; *Jangli haldi,* BHOPAWAR; *Tebu,* SINGHALESE; *Pa-lan-toung-Wae,* BURMESE; *Kemuka,* SANSKRIT; *Tawe-tawe autar, setawa, satawa,* MALAY. **Vernacular.**

This plant is the *Tjana-kua* of Rheede and the *Herba spiralis hirsuta* of Rumphius.

Habitat.—Common throughout India in moist shady places, as in forests, and near water. The plant has large white flowers with red calices and glossy leaves. **Habitat.**

The plant is wild and sometimes cultivated. It is easily propagated by sub-division of the roots. The plant flourishes in the rains, flowering in the month of August and September and fruiting in December. The leaves remain till January, but the plant dies away in the hot weather. The plant has the appearance of ginger, and the rhizomes resemble commercial samples of ginger in their growth, structure, size and colour. They, however, possess no aromatic properties, and the taste is mucilaginous and feebly astringent. It could only be used as a substitute for ginger by being preserved with a quantity of that root sufficient to flavour it.

Food.—The roots of this plant have long been considered wholesome and nutritious, and during an enquiry into the famine foods of

COSTUS SPECIOSUS. Food.

India conducted by the Reporter on Economic Products the root has been supplied by officers in Bengal, United and Central Provinces and in Central India, as a staple food among the poorer classes.

Before it is eaten the root is boiled like potatoes ; in Raipur, Central Provinces, the root is first broken up into a pulp and boiled and eaten as gruel. Whether eaten by itself or mixed with other roots or grains it is considered a good vegetable. The root is cooked in syrup and made into a preserve in some parts of India.

Medicine.

Medicine.—In addition to its alimentary uses the root of **Costus** is employed for medicinal purposes. Dr. Irvine in the "*Materia Medica of Patna*" says, the root is given in mixtures in doses of 40 to 120 grains. "The root is sold in the bazars at two annas=*2d.* per pound." In Naini Tal the root is said to be good in cold and rheumatism. In Central India the root is powdered, mixed with crude sugar, and taken by patients suffering from pneumonia ; it is also considered a tonic. Stewart remarks that the root is given as a depurative and aphrodisiac in the Panjáb. It is used by Santál ojhas for "pain in the marrow." It appears that wherever the plant grows the root is supposed to be efficaceous in diseases, and Ridley points out that it is used in medicine in Malaya (*Journal of the Royal Asiatic Society*, Straits Branch, No. 30, 1897, page 247) under the names of *Setawa*, *Satawa*, *Tawa-tawa* and *Tawagas*.

Chemical Examination.—Fresh roots collected near Calcutta in the month of November were cleaned and dried. In a fresh condition the roots were nearly white ; the average weight of twenty specimens was 220 grams. The moisture varied between 77·5 and 87 per cent. The starch granules are oval, eliptic or club-shaped, the elongated grains are either straight or curved.

Analysis.

Dried and reduced to fine powder the rhizome yielded the following composition :—

Moisture	5·50
Ether extract	·75
Albuminoids	6·75
Carbohydrates	66·65
Fibre	10·65
Ash	9·70
	100·00
Total nitrogen	1·33
Albuminoid „	1·08
Phosphoric acid	·36
Sand	1·95

The ether extract consisted of an oleoresin dissolving in sulphuric acid with a yellowish-brown colour changing to blue. An alcoholic extract of the powder contained a large quantity of sugar. The food is fairly nutritious and contains a larger proportion of fibre than most tuberous substances used in food.

s.—There has been much confusion between this plant and the **Costus** of ancient writers. **Costus** is an important spice, incense, and medicine known from antiquity down to the present time. It is the root of **Saussurea Lappa**, *C. B. Clarke* (**Aucklandia Costus**, *Falc.*) which is remarkably similar to elecampane both in external appearance and structure, being an allied plant of the composite order. The true origin of Arabian **Costus** was shown by Dr. Falconer in 1845 (*Transactions of the Linnean Society*, XIX., 23), and a full account of its use in mediæval Europe and its substitutes was written by Dr. M. C. Cooke in 1877 (*Pharmaceutical Journal* (series 3), VIII., 41). **Costus** known also as *Kut*, *kust* and *putchuk* is collected in Kashmir and is sent to Bombay and Calcutta where it is exported in large quantities to China to be used in incense.

Costus of the ancients.

G. I. C. P. O.—No. 445 R. E. P.—18-8-1906—25,00—H. R.

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THE

AGRICULTURAL LEDGER.

1906—No. 3.

ACACIA CATECHU.

(CUTCH.)

[*Dictionary of Economic Products, Vol. I*, A. 135-199.]

Composition and Trade Forms of Indian Cutch, by DAVID HOOPER, F.C.S.

Introduction.

INTRODUCTION.

The present Agricultural Ledger is written with the object of bringing together information on the manufacture, trade forms and composition of Indian and Burmese cutch. Reference is made to the distribution of the **Acacia Catechu** and the centres of the cutch markets, which hitherto have but been the subjects of scattered notes in periodicals. Analytical tables are given of the composition of most of the available trade varieties of cutch and these will enable an estimate to be made of their comparative values. For medicinal purposes it is important to know the amount of astringency, and the presence and nature of impurities to be met with in the Indian samples, in order to compare them with Gambier of the Straits Settlements which is appreciated as a substitute in this country and is being recognised in the Pharmacopœias of other nations. The trade in cutch has been declining of late years, and it is hoped that the publication of these results will give an impetus to an important indigenous industry.

TREES WHICH YIELD CUTCH.

The cutch tree of India is known as the *Khair* and the extract is called *Kat*, *Kath* or *Katha*., The **Acacia Catechu**, *Willd.*, was regarded as a distinct species by Dr. Roxburgh, and the allied species, **A. catechuoides** and **A. Sundra,** were recognised as being used with the first in the preparation of the commercial extract. In 1897, however, Lieutenant-Colonel D. Prain, LL.D., F.R.S., regarded these three trees as varieties of one species, and in a paper entitled "Some Additional Leguminosæ" (*Journal Asiatic Society of Bengal*, Vol. LXVI., Pt. II., pp. 508-9) he established the characteristics and respective areas of distribution of the three forms of the plant.

CUTCH-YIELDING TREES.

Colonel Prain's conclusions may thus be summarised:—

(*a*) **A. Catechu**, *Willd.* (proper). This is the most Northern form having been recorded as met with in Hazára, Kashmir, Simla, Kángra, Garhwál, Mussoorie, Central India, Bihár and south to Ganjam. It has never been found in the Eastern Himalayas nor in Assam, and it has only once been reported as met with in Burma, *viz.*, at Pegu, where according to Kurz it is called *sha*. This is therefore the kath-yielding form of Kumaon or *papri khair* as it is sometimes called.

(*b*) **A. catechuoides**, *Benth.*, is met with in Bengal from Monghyr and Patna to Sikkim, Assam and Burma. Though quite common in Pegu and Prome it has not as yet been collected in the Shan Hills nor in Upper Burma to the north of Ava. This is therefore the cutch-yielding form of Burma; and Pegu or Rangoon cutch is the chief commercial form of the extract.

(*c*) **A. Sundra**, *DC.* Colonel Prain distinguishes this as the Southern and Western plant which affords the cutch of Madras and Bombay Presidencies. It is very common from Coimbatore northwards to the Deccan, Kángra and the Konkan, and has been recorded as far towards the north-west at Kathiawar and in Rajputana, also to the north-east in Burma, at Segain, Mandalay and the Shan Hills. It is the *lál khair* or Red Catechu.

How far these varieties of the tree influence the composition of the extracts made from them will be noticed in discussing the chemical composition of trade samples. Before dealing with that subject it will be convenient to refer to the districts in India where cutch is manufactured and to describe the peculiarities of manufacture that regulate the trade forms.

WHERE MADE.

Bengal.

Bengal.—One of the earlier writers on the industries of this province is Dr. Buchanan-Hamilton whose diaries were edited by Montgomery Martin. He described in 1838 the manufacture of *Khair* from **Acacia Catechu** in Dinajpur. The tree is common in the woods of Peruya, Jagadol and Ghoraghat; but it is only in the first that any of the drug is prepared. The number of people employed in this manufacture is small. Trees are selected that are at least two feet in circumference and these are old; for in this district the tree does not grow to a large size. The bark and white wood are removed and then the heart-wood is cut into small pieces and beaten into a kind of stringy substance by means of an instrument called a *dhenki*. Equal quantities of this and of water are put into earthen pots, each holding from 10 to 20 seers (20·5 lbs. to 41·1 lbs.) and are boiled for about six hours. Each fire contains two or three pots. The decoction is then decanted into a pot, and is formed into two kinds of catechu, *khair* and *papri khair*, the first dark and the second light coloured. The first is made by simply allowing the extract to dry in the pot without addition, the second is made by putting some ashes of cow-dung

CUTCH WHERE MADE.

in the bottom of the cooler. The ashes are covered with a fold of muslin, over which the warm extract is poured. It is sold to the merchants in these pots and by them is formed into balls and dried in the sun. The season for manufacturing cutch is from November to March ; none can be made in these districts in the rainy season.

Maldah.

A small quantity is made in Maldah, but the Maldah Khair is not reckoned of best quality, and the tree is rather scarce in the neighbourhood.

Chutia Nagpur.

The industry is more or less reserved in Palamau in Chutia Nagpur by an inferior caste called Mallahs, who extract *kath* from November to March. They do not cut very small trees, which have little or no heart-wood, and they never touch old trees. Trees from 2′ to 4′ in girth are generally cut for the purpose. The sapwood is removed and the heart-wood is split up into thin chips with axes. The chips are then boiled in earthen vessels for 10 or 12 hours and the solution obtained is poured in separate vessels and boiled over again, and this goes on till the liquor acquires the consistency of a thick syrup, which is then kept in big bamboo baskets lined outside with earth and cow-dung. After a few days, when the thick syrup becomes paste-like, it is poured over *chatáis* (mats) strewn over with ashes, and made into any forms the manufacturers like. The *kath* or cutch obtained by first boiling the chips is of best quality, and that obtained by second boiling is of second quality, and sometimes a third boiling is made when a third class extract results.

In other parts of Chutia Nagpur *kath* is prepared and sold in the Manbhum and Jhalda pergannahs. The annual production in Manbhum is estimated at 40 or 50 maunds (29·38 cwt. or 36·73 cwt.), and the rate of sale is about four seers (8·22 lbs.) a rupee (1*s.* 4*d.*) when dry. In Jhalda the outturn is smaller, as the neighbouring jungles contain fewer trees.

Dr. McCann in his "Dyes and Tans of Bengal" (1883) reported that about 1,000 maunds (734·69 cwt.) of catechu was annually consigned from Hazaribagh in Chutia Nagpur to Calcutta, where it sold at from R8 to R12 (10*s.* 8*d.* to 16*s.*) per maund (82⅔ lbs.).

Patna is the emporium of Janakpuri cutch and of that made near Garhwa in Palamau, Chetra in Hazaribagh, Ahraura in Mirzapur and Bas Bareilly, Pilibhit and Katni Marwar.

Nepal. Tirhoot.

Janakpuri cutch is prepared in Nepal and the Nepal Terai and is brought to Patna through the frontier stations of Tirhoot, Champaran and Bhagalpur. It receives its name from the town of Janakpur (Pupri) in Muzaffarpur. It is manufactured at Raksal and Katkanwa in Champaran, Bairagania, Birganj and Janakpur in Muzaffarpur, Bhimnahar and Bhaptiahi in Bhagalpur, and Madhuapur in Darbhanga.

Janakpuri cutch.

Janakpuri cutch is made from the wood of the *khair* tree by boiling the chips in an iron pan and straining the liquor through cloth. It is again boiled until it becomes thick, when the extract is

CUTCH WHERE MADE.

spread over a cloth or gunny placed on sand and dried in the shade. It is supposed that drying in the sun has a deleterious effect and produces a black cutch of inferior quality. The only restriction on the manufacture is the payment to the Forest Department of R4 (5*s.* 4*d.*) for each maund (= 82¾ lbs.) of extract prepared.

The cutch obtained in the Patna market is of the Janakpuri variety and is divided into three classes according to its quality—

	Per maund. = 82¾ lbs. R
1. Pakra or hatipawn . . . (29*s.* 4*d.*)	22
2. Kachru . . . . . (27*s.* 8*d.*)	20
3. Talia, pakri or kala . . . (21*s.* 4*d.*)	16

The first has an earthy pinkish fracture, and is full of catechin, the second is darker with a moderate amount of catechin, while the third quality is black in colour, having a brittle, shining fracture.

Orissa.

In 1893 the Secretary of the Bengal Chamber of Commerce wrote to the Reporter on Economic Products, suggesting an enquiry into the origin of the cutch made in Orissa and the Orissa Hill States. Armenian and Jewish traders are aware that before Burma cutch took possession of the market, Orissa cutch was well known in Calcutta. The Secretary of the Chamber had purchased cutch at Chandbali where it was called "Black Heart." It was badly prepared and was sold in hard dark coloured cakes. The enquiry was passed on to the Conservator of Forests, Bengal, and the following notes regarding the trade carried on in cutch in the Orissa Tributary States were supplied by the Officiating Superintendent, Cuttack.

The article is not considered a very paying concern in the Tributary Mahals, and the trade is confined only to the following six of the seventeen States:—Athmallik, Bod, Daspalla, Mohurbhanj, Pal Lahera and Talcher.

The Tributary Mahals forests do not abound in catechu plants, and where they do the manufacture of cutch is carried on to a very limited extent. It is manufactured by a professional class of aborigines called *Khairas* or cutch manufacturers, the tract of the jungle being first leased either by traders from the plains or the *Khairas* themselves. The quantity manufactured finds ready sale in the Garjat local markets and in Cuttack.

The quantity turned out is not large. In Athmallik the Maharaja reports the value of the manufactured article to be not more than R1,000 (£66 13*s.* 4*d.*) during 1893. In Bod and Daspalla, the annual outturn is estimated to be 300 maunds (= 220·4 cwt.) and 50 maunds (= 36·73 cwt.), respectively. In Mohurbhanj, Pal Lahera and Talcher the quantity manufactured is not more than sufficient for local consumption, though sometimes in the two latter the surplus is exported to Cuttack.

CUTCH WHERE MADE.

Buxa in Northern Bengal.

In the Buxa Forest Division, the trees are of the ordinary kind that grow plentifully along old river beds and on waste land all over the country. All trees yield more or less extract, but there seems to be a great difference in the quantities obtained from the wood. It appears that those most gnarled and creviced and generally badly used matured trees give the largest yield; this opinion is supported by the fact that the crystalline catechin may be picked out of the cracks and cavities in the heart-wood. If a khair tree be cut down in the rains a crystalline substance oozes out from the centre of the stump as well as from the log. A specimen of this was separated by boiling the chips cut as small as possible in a kerosine tin of water for half an hour; the decoction was then strained into shallow wooden boxes and set to cool. In from two to four days the catechin crystallised out and adhered to the sides and bottom of the box. Most of the dark brown liquid was then poured off and the balance was stirred up and turned into a filter-press and squeezed into a cake. The cake was then dried in the sun, after which it had a brown appearance from a portion of the tannin drying on the surface. This process aimed in getting catechin, and this could be obtained almost pure by washing with sufficient water.

Cutch may be made from the bark as well as from the heart-wood of the tree, but in the former case the extract is very black and, as shown by analysis, contains no catechin.

Assam.

Assam.—The khair tree is distributed in this province and is abundant in the districts of Goalpára, Kamrup and Darrang, but no cutch has ever been made there on a large scale. The product is almost unknown among native manufacturers and in a commercial sense is almost non-existent.

Central Provinces, Eastern parts.

Central Provinces.—Regarding the trade in cutch in certain feudatories attached to the Sambalpur district, the following information has been communicated.

Sonpur is a Native State lying to the south of Sambalpur district and the Mahanadi traverses it from north-west to south-east, so that whatever cutch is produced there is carried away by river to Cuttack and does not pass through Sambalpur. There is very little forest in the State, it is a plain country and has been to a great degree brought under cultivation, and it is not probable that there can be any considerable trade in cutch in this State.

Patna Native State lies to the south-west of Sonpur and only touches the Bargarh Tahsil of the district in the extreme south-west. It is reported that Patna is a well wooded State and it is probable that a fair amount of cutch is produced there. Everything not needed for home consumption is exported to Sonpur and thence down the Mahanadi to Cuttack. The production of cutch in Patna State is about equal to the production in Bamra.

Bamra State lies to the east of this district. It is covered with dense forest and yields a good supply of cutch. In Bamra the

CUTCH WHERE MADE.

Central Provinces, Eastern parts.

Feudatory Chief is the principal merchant and nearly all the cutch produced in the State is carried to his depôts and delivered to his agents at a fixed rate. The Chief's agents sell it to traders who carry it away by rail or river. The Feudatory Chief of Bamra has kindly furnished the following information regarding this subject :—

Cutch is produced in the Atpara, Naikool and Gourpali parganas of the Bamra State. The annual production does not exceed 250 maunds. No merchant purchases directly from the producers. All the cutch produced is purchased by the Chief at from 4 to 5 rupees (5*s.* 4*d.* to 6*s.* 8*d.*) per maund (=82⅔ lbs.) and is sold again at his depôts to merchants at from 7 to 8 rupees (9*s.* 4*d.* to 10*s.* 8*d.*) per maund. It is also probable that a small quantity is smuggled out of the State by traders without passing through the Chief's depôts.

Radakole is a State with more jungle than cultivation and the production of cutch there must be equal to the production in Bamra State. Some of the cutch produced in the western part of the State is carried by men or on pack bullocks to Sambalpur for sale, but the major portion goes down to the river to Cuttack or by road through Angul to Cuttack.

All the cutch exported from the feudatories of this district is usually in the form of soft cutch.

The Conservator of Forests reports that in Sambalpur earthen pots are used for boiling down the liquor. The thick liquid, when sufficiently concentrated, is poured into small cups made of palmyra or other leaves and exposed to the sun for 10 to 15 days, when the cutch becomes hard and dry. It is sold locally at 4 annas (4*d.*) per lb. or R10 (13*s.* 4*d.*) per maund (82⅔ lbs.).

Central Provinces, Central parts.

The Deputy Conservator of Forests, Seoni, describes the process of making the square-shaped cutch at Korai. When the extract is of the consistence of a thick paste it is poured into moulds made of fine sand. The sand absorbs what little moisture is still left in the paste and the Katha remains. This is cut into small blocks about two inches square by half an inch in thickness. These are sold by contractors in the Kampti market.

Central Provinces, Northern parts.

In Damoh, another district in the Central Provinces, the cutch boiling industry has been carried on for many years by professional *Khairwas*. The quantity of *Katha* manufactured in 1903-04 was about 400 maunds (=293·87 cwt.), the market value of which at R11 (14*s.* 8*d.*) per maund (82⅔ lbs.) was R4,400 (£293 6*s.* 8*d.*).

United Provinces.

United Provinces.—Major Madden during his tour in 1847 through "The Turaee and other mountains of Kumaun" (*Journal Asiatic Society, Bengal, XVII., 565*) describes the manufacture of kath or catechu by a class of Doms called *Khairias*, after the name of the tree. Trees with an abundance of red heart-wood are most esteemed, and these are reduced to thin slices and boiled in Kedgree pots. Madden speaks of the kath in the concentrated liquor crystallising on leaves and twigs thrown into the pots for this

CUTCH WHERE MADE.

purpose. Later observers state that twigs are not now used to assist crystallisation, and that the evaporating liquor is stirred with sticks dipped in castor oil to prevent frothing. There is a fair local demand for Kumaun kath, but the manufacture and trade are in the hands of poor unenterprising people, and there does not seem to be any promise of much expansion. Another evil threatening the once flourishing industry is the gradual extermination of the Khair tree by annual savannah fires; and Government propose to remedy this by reserving 12,000 to 15,000 acres of khair forest, and arranging for their protection against fire and grazing.

Bombay Presidency, North Kanara.

Bombay.—Dr. Buchanan-Hamilton describes the making of *cut* or catechu near Ankola in North Kanara during his tour in 1801. The trees grew spontaneously on the hills of the Konkan and were observed nowhere else in the peninsula. The extract was made by boiling the chips of the heart-wood in the usual way, and when it was sufficiently hard it was poured on to the ground covered with rice husks and made into balls about the size of oranges and dried in the sun seven days. These were sold to merchants residing at Dharwar and Stanore, who supplied the greater part of the peninsula with this article, which among the natives was in universal use. The greatest supply came from that part of the Konkan which was subject to the Marathas and was considered of very good quality.

Possibilities of Nasik.

In a recent Forest Report it is said that in the Nasik division of Bombay, Khair trees will never yield valuable timber and the extraction of catechu in these forests would produce a revenue which could not otherwise be tapped.

Gujarat.

People employed in Gujarat in the manufacture of kath or catechu are called Kathodias, an aboriginal tribe much resembling Bheels. The men bring in the khair wood from the jungle and cut it into chips; the women boil the chips and extract the kath.

The tree best suited for the purpose is one of from 25 to 30 years of age, and the more thin white lines visible in the heart-wood the greater is the quantity of kath it contains. The Kathodia tests whether the tree will pay to fell by cutting a small notch into the heart-wood.

After the tree is cut the Kathodia removes all the sap-wood, and a little of the heart-wood with it, from the bole, and takes it home to cut into chips, which he does with a small axe of a peculiar shape. The chips are about the thickness of wood used for match boxes and about a square inch in surface.

The chips are boiled in small earthen pots, with rather more than two quarts of water; the chips are renewed three or four times a day, three or four handfuls being put in each time. The water is poured off from time to time when considered sufficiently impregnated with kath into two pots kept on purpose, and allowed to go on boiling; fresh water is put into the pots from which the liquid has been poured off.

CUTCH WHERE MADE.

Gujarat.

At the end of the day the infusion in the two pots is poured into a wooden trough, about a yard long and eighteen inches broad, and goes through a peculiar process of straining. A woman takes a piece of blanket about a foot square, dips it into the infusion, stirs it about and then wrings it out again into the trough, holding it as high up as she can from a sitting position. This process goes on for about two hours, after which the trough is covered up with a lid made of split-bamboos, and the infusion allowed to throw down a sediment which is kath; all the water is poured off and the kath is made into small pats and allowed to dry.

Kath, ready made, is sometimes found in the centre of some trees. This kind of kath is the most valuable, and is called Khersal.

The Kathodias are employed in large gangs from 50 to 75 families (each family represents a kath furnace) by contractors who obtain permits from the Forest Department for the manufacture of kath and make their encampment near a river in the jungle so as to have a large supply of water at hand; a kath furnace has from eight to twelve pots placed in a double row. The two central ones are used to receive the liquid from the other pots.

Kath manufacture is very destructive, and should never be permitted in jungles where the khair grows straight or is accessible. If allowed, only such trees should be marked as are not fit for timber, by reason of their crookedness or other defect. In the Bombay Forests, where manufacture of kath is allowed, none but crooked trees unfitted for timber uses are felled, and every tree is previously marked for the axe by an officer of the Forest Department. [*J. Macrae, Indian Forester*, Volume I., (1875) 282].

Madras, South Kanara.

Madras.—In this Presidency cutch is most extensively manufactured in the Kanara district. The method of preparation in South Kanara is given in the District Manual, from which the following extract is taken:—

"The catechu trees are felled, and their branches and sap-wood removed. The heart-wood is then chopped into small chips about $1\frac{1}{2}$ inches by 1 inch in size. About $2\frac{1}{2}$ maunds (1·83 cwt. or $205\frac{5}{7}$ lbs.) of chips are put into an earthen pot containing a maund (=9·8 gallons) of water and boiled for two hours. When the active principle of catechu has separated from the chips, the decoction is strained into a trough placed at the foot of the still and immediately transferred to another vessel of which about half a dozen are placed on the ovens in a line. The chips once boiled are again mixed with the same quantity of water and again boiled. The process of boiling and straining is repeated six times and at every time the decoction obtained is strained and transferred to the pot containing the former decoction. The decoction is itself boiled again for about six or seven hours until it attains a dark brown colour and becomes gummy. It is then discharged into an open, shallow vessel and stirred by a ladle until it becomes semi-solid by oxidation, which it does in about five or six hours. It is made into balls, each of $1\frac{1}{2}$ inches in diameter, and the balls are rolled in ashes. The above preparation is said to produce 45 balls weighing $10\frac{1}{2}$ lbs. Here ends the work of the people—males

CUTCH WHERE MADE.

South Kanara.

and females of the Kudubi caste—engaged for the purpose. After receiving the balls from the Kudubis the contractor has to go through a further process of rubbing them five or six times for two or three days, heaping them upon an air-tight covering of ashes, in which state they are kept for three or four days, and then giving them another rubbing, after which they are spread out in the shade to dry; when dried the above 45 balls weigh about 9 lbs. The balls thus prepared are delivered over by the contractor to the Forest Department, which pays him the price agreed upon, *viz.*, R60 (£4) per candy of about 3,000 balls.

"The manufacture of catechu is carried on from about the end of December to the middle of March. It is confined to a jungle tribe, called *Kudubis*, who speak a dialect of Konkani and are said to have migrated into the district from Goa when it came under the sway of the Portuguese in the sixteenth century. When the Kudubi is engaged in the manufacture of catechu, he makes the site of the boilers his home, the Kudubi woman being as much essential to the work as the Kudubi man. The work of the male ends when he has felled the trees and cut the heart-wood into chips; all the rest of the process until the catechu balls are delivered to the contractor falling to the share of the female. The Kudubi gets from R1 to R1-4 (1*s.* to 1*s.* 4*d.*) for every 100 balls manufactured or R40 to R50 (£2 13*s.* 4*d.* to £3 6*s.* 8*d.*) for every 4,000, balls which is generally the unit of account between the contractor and the Kudubi. During the three years ending with the 31st March 1894, about 49 tons of catechu were manufactured at a cost of R11,630 (£775 6*s.* 8*d.*) and the sale of these realised R25,857 (£1,723 16*s.*), leaving a total profit of R14,227 (£748 9*s.* 4*d.*) or R4,742 (£316 2*s.* 8*d.*) per annum to the Forest Department. The manufacture of catechu gives employment to nearly fifty or sixty families of Kudubis and the average monthly income of a family amounts to about R8 (10*s.* 8*d.*)

"The catechu manufactured in South Kanara appears to command a higher price than the product of Mysore on account of the careful and neat method employed by the Forest Department in its preparation; the former fetches R135 (£9) per candy, while the latter scarcely realizes more than R100 (£6 13*s.* 4*d.*) The catechu manufactured in South Kanara is chiefly sold in Mysore where it is eaten with *pán* (betel leaf) and administered as a medicine to women immediately after confinement."

Market of cutch from South Kanara.

In 1903-04, 1,561 maunds (Madras maund = 25 lbs.) or 18·8 tons of catechu were made in South Kanara and sold for R13,953 (£930 4*s.*). The departmental cost of the extract was R172 (£11 9*s.* 4*d.*) per ton and it realised R801 (£53 8*s.*) per ton. A few tons were sold to the Harness and Saddlery Factory at Cawnpore, and the Mysore State took the remainder for consumption. In 1904-05, 1,466 maunds (16 tons) were made and sold for R11,431 (£762 1*s.* 4*d.*). The cost price being R160 (£10 13*s.* 4*d.*) per ton and the selling price R700 (£46 13*s.* 4*d.*). An interesting account of catechu and catechu boiling in South Canara, written by Mr. H. A. Latham, appeared in the *Indian Forester*, May 1906.

Burma.

Burma.—In Lower Burma the manufacture of cutch is carried on in much the same way as in other parts of India. If trees are plentiful the manufacturer makes an incision into the heart-wood before felling, to determine whether or no the wood is spotted or

CUTCH WHERE MADE.

Burma method of manufacture.

whether it contains *ugyi* (the Burma name for kersal). The presence of such spots indicates catechin and assures the outturn of a hard cutch which is of greater value than soft. The presence of *ugyi* is therefore of primary importance and trees without spots are rejected if there is a sufficiency of trees with them. According to Mr. H. Slave ("Cutch Manufacture in Burma," *Indian Forester*, 1892) cutch boilers recognise four varieties of **Acacia Catechu** distinguished by their bark and the colour of the heart-wood. These are Sha-ni or red cutch, Shaw-wa or yellow cutch, Sha-bya-Kyaung-mwe or blue cutch, and Sha-net or black cutch. Of these four varieties red cutch is considered the best, the cutch manufactured from the blue cutch will never set by itself, so it is always mixed with the extract from one of the other varieties.

The selected trees are deprived of their bark and sap wood and the logs are cut up into convenient lengths of about 7 feet. These logs are converted into chips about an inch square and a quarter of an inch in thickness. The boiling of the chips with water is conducted in several earthenware pots each containing about three gallons, and the extract is transferred to a large iron pan of the capacity of twelve gallons. The liquid is boiled down until it attains, with constant stirring, a viscous consistence. The cauldron is then taken off the fire, and to prevent the extract from solidifying at the top before it does so at the bottom, it is constantly stirred with a flat piece of wood shaped like a paddle until it is cold enough to be handled. It is then poured into a brick shaped mould, generally lined with leaves, and left to cool. The result is a mass of dark cutch varying in consistence according to the quantity of kersal contained in the wood used.

In Upper Burma the process of manufacture is generally the same as in the Lower Province. In 1890-91 cutch was being manufactured in the following seven forest divisions, that giving the largest outturn being placed first:—Minbu, Pyinmana, Yaw, Mu, Mandalay, Katha and Chindwin. In the Yaw Forest of the Mu division a somewhat different form of cutch is made other than that of the conventional article. The cutch is boiled in the ordinary manner, and is then thrown into a bamboo basket to see whether it will set. When it becomes hard it is put back into the cauldron and re-melted. A good quantity of *thau* (**Terminalia Oliveri**) bark is added to give it a good colour and harden it. It is then thrown into small conical moulds made by pressing a blunt-pointed stick into the ground and lining the holes thus made with leaves of **Cassia Fistula** or a species of **Bauhinia**. When the cutch has solidified the leaf moulds are stripped off the cakes.

Markets of Burmese cutch.

This cutch is made specially for the Shan market and is only used for chewing. It is sold at Bhamo at ₹24 to ₹30 per cwt. The quantity produced is comparatively small.

Burmese cutch is often sold in the shape of small blocks. This

CUTCH WHERE MADE.

is accomplished by using a mould with the dimensions of 3′×8″×1,″ and before the cutch is thoroughly set it is cut into strips about 3 or 4 inches wide; the cutch then assumes the form of slabs found in the market, the dimensions of which are 3″×8″×1″.

Minbu.

From the Sinbyugyun forests of the Minbu division of Upper Burma varieties of cutch are known as black, yellow and red. The colours are said to be much more apparent where the cutch is fresh from the boilery. A forest official states that they are all manufactured by the ordinary Burmese process, the only difference being in the shape of the mould employed. The yellow cutch of Pegu occurs in roundish cakes about two inches in diameter and half an inch in thickness. The colour externally is yellowish-brown and internally reddish-brown. There is nothing in the analysis to account for the colour.

Prome.

In the Padaung township of the Prome district a few boilers adopt a somewhat different process and form the product into balls. Only earthenware pans are used for boiling and evaporating the liquor. The thick extract is poured into a wooden trough and agitated by a long stirrer until it commences so solidify. It is then rolled into balls about the size of marbles. The balls are dried on palm leaves near a fire. As soon as they begin to swell slightly they are removed and are ready for market where they sell for R30 (£2) per cwt.

Experiments in India.

MANUFACTURE, IMPROVEMENT OF.

Experiments have been made in India to elucidate some of the obscure points connected with the native methods of manufacturing cutch. Dr. Warth in 1890 tested the quality of the wood of the Catechu tree by taking several samples showing a large and small proportion of spots in the heart-wood, to verify the statement of Kath makers that the white spotted wood yielded a superior extract than that made from black heart-wood. The result of the experiments showed that spotted wood gave more extract as well as more catechin. Authenthic specimens were collected in Oudh and Burma and were of the following description :—

Recognition of good wood.

Oudh No. 1.—Reported unfit for making *Kattah*, 1 in 1,000 of white pores.

Oudh No. 2.—Reported good for *Kattah*, 1 in 6 of pores.

Burma A.—No white spots, but *khersal* present.

Burma B.—Exhibiting white spots, 1 in 20.

Burma C.—White spots 1 in 3.

	Maximum per cent. extract.	Mean per cent. Catechin.	Catechin per cent. in wood.
1	14	36	5
2	24	40	9
3	17	14	2
4	16	31	5
5	20	28	6

CUTCH MANUFACTURE, IMPROVEMENT OF.

As might be expected these results show that deposits of catechin exhibited in the wood contribute to form an extract of good quality; on the other hand, there is evidence of good cutch being manufactured from wood reported by professional boilers to be unfit for use.

Cutting up wood.

Dr. Leather next dealt with the best methods of cutting up the timber, with the effect of different kinds of water, the quantity of water required and the time which was essential to boil the wood.

1. With regard to the form in which the wood should be used. Experimenting with wood in the form of chips, sawdust and shavings and treating them with boiling water under similar conditions, it was shown that the chips yielded 3·8 per cent. of extract, the sawdust 12 per cent. and the shavings 15·1 per cent. The conclusion is thus easily drawn that the finer the state of division of the wood the greater quantity of extract is obtained.

Amount of water for boiling.

2. The second point was the amount of water to be used in extracting the wood. Experiments in this direction proved that ten parts or less of water to one of wood was ample for exhausting the soluble contents. In this connection it was shown to be immaterial to the process whether the water used was hard or soft.

Time required for extraction.

3. The time required for extraction. The native cutch-makers boil the wood for several hours, but it appears that half an hour is quite sufficient to exhaust the wood. The prolonged boiling is conducted by the cutch-maker as the second part of the process, *viz.*, the concentration of the extract.

The Yield.

Yield.

The amount of extract obtained from the heart-wood of the khair tree varies considerably in individual samples. Dr. Warth obtained 6 to 14 per cent. in unspotted heart-wood, and 4 to 24 per cent. in spotted heart-wood from the United Provinces, and in samples from Burma 12 to 17 per cent. in unspotted wood and 14 to 20 per cent. in spotted wood. In Pegu, where the manufacture is on a large scale, it is calculated that 250 to 300 pounds of cutch is yielded by 1 ton of wood. This is equivalent to 11·1 to 13·3 per cent. A sample of the chips used in the Burma factory was estimated by me in 1900 and was found to contain 14·3 per cent. of total dry extract: a very fair proportion of the soluble contents is therefore extracted by the factory process.

In the South Canara District, Madras, the yield of extract from heart-wood chips is about 11 per cent.

Trade Forms of Cutch.

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Pegu cutch.

Pegu Cutch.—This form enters Commerce through Rangoon or Calcutta. It occurs in large solid masses, sometimes weighing one hundredweight, or is made up of flat quadrangular cakes about 6 inches long and 1 inch in thickness. Both forms are usually wrapped in leaves or have leaf impressions on the outside. The leaves employed for this purpose are those of **Dipterocarpus tuberculatus, Stephegyne diversifolia** and the scabrid leaves of

CUTCH TRADE-FORMS.

Tectona hamiltoniana. This cutch is dark reddish-brown and breaks with a shining fracture into angular and irregular fragments showing a compact or porous structure according to the heat employed in drying. Scratched with a knife, light reddish-brown markings are exposed. In the Calcutta market this form is known as *Pegu, Rangooni* or *Mogai Khair*, and is sold at R26 (£1 14*s.* 8*d.*) per maund (82⅔ lbs.)

Janakpuri.

Janakpuri khair.—This is the pale catechu of Bengal made, as already stated, in Gya, Chatra and Hazaribagh, and brought into Calcutta from Patna. It is used extensively by the Kabirájs in medicine and by Marwaris and Bengalis for chewing purposes. It occurs in large masses or flattened cakes or balls and is of various qualities ranging from R28 to R23 (£1 17*s.* 4*d.* to £1 10*s.* 8*d.*) per maund (82⅔ lbs.). The larger blocks are called *hathi pà* (elephant's foot) from their resemblance to the shape and colour of an elephant's foot. Smaller forms are made into square cakes or rounded balls, both showing a laminated structure due to the presence of catechin.

Tela khair.

Tela or tele khair.—This is the dark or black cutch of Bengal brought from Patna to Calcutta and sold in various shapes. It occurs in masses of a black or pitch-like appearance having a shining fracture. It is probably a by-product in the manufacture of the light catechu. There are two principal varieties of this cutch, the name *tela* generally being applied to the crude article as it is imported, and *mansarami*, a refined cutch of better quality. In the refining process the catechu is first dissolved in boiling water, the liquid strained from impurities and then evaporated by boiling. The residue before it hardens is then cast into two shapes :—

(*a*) round or *bélguti* (from *bél*, the fruit of **Ægle Marmelos** which it resembles) and

(*b*) square, called *chauk, chaukhabi* or *kalagaran.*

Tela cutch is the cheapest kind sold, costing only R12(16*s.*) per maund (82⅔lbs.). It is this kind which is used with concrete in preparing the roofs of houses, as it is supposed to enter into combination with the lime and render the composition more durable. *Tela khair* is also moulded into various ornamental articles and made as presents offered at wedding ceremonies.* It is on account of its low price used by the poorer classes for edible purposes.

Pale cutch.

Pale cutch of the United Provinces and Kumaon.—Is lighter in colour than that of Bengal and contains abundance of catechin.

Cawnpuri cutch

Cawnpuri cutch.—Is a variety of Kumaon cutch and occurs in irregular or rectangular cakes about 2 inches square, dull pinkish fawn inside, and breaking with a tough earthy fracture showing a laminated structure. The price is R32 (£2 2*s.* 8*d.*) per maund (82⅔lbs.), and as its name implies is exported from Cawnpur.

* See "Some Instances of Vegetable Pottery." *Journal of the Asiatic Society of Bengal*, Vol. II., Pt. 3 (1906), page 65.

CUTCH TRADE-FORMS.

Chana makhan khair.

Chana makhan khair.—Literally "curd and butter cutch," is a pure form of Kumaon cutch used largely in the Benares district. It occurs in rectangular blocks, somewhat smaller in size than the Cawnpur kind, and is of a more uniform consistence and paler colour. It is the dearest cutch in the market as it sells for R35 to R40 (£2 6*s.* 8*d.* to £2 13*s.* 4*d.*) per maund (82⅔ lbs.), and is used almost exclusively for chewing purposes.

Gambier.

Gambier.—This well-known article is imported from Singapore and is employed in dyeing as well as for chewing by Bengalis. It is the pale or (from its shape) cube catechu of commerce, but its most approximate term is gambier, which distinguishes its origin from that of the numerous Indian varieties of cutch. Gambier is called *papri, gata* or *gooti khair* in the Calcutta market where it sells for R17 (£1 2*s.* 8*d.*) per maund (82⅔ lbs.).

Prepared or mixed cutch.

Prepared or mixed cutch.—In addition to the simple extracts various preparations are locally sold in the market. A peculiar mixture named *gora khair* is made in Calcutta from gambier, Janakpuri cutch and *lál mati* (red earth). This appears as a tough extract of a reddish colour and is invariably wrapped in leaves of the *sál* tree (**Shorea robusta**). It is also called *sálpata-wala* from the fact of these leaves being used as a covering. The soft extract is sold at R12 (16*s.*) per maund (82⅔ lbs.); it ultimately dries to a hard cake.

Kaya khair.

Kaya khair.—This is another preparation of cutch made by mixing together gambier and tela cutch, coriander, caraway, anise, cloves, cinnamon and cardamom with the flowers of the kaya or screw pine—**Pandanus fascicularis** (*Syn.* **P. odoratissimus**). The moist mixture is wrapped in leaves of pandanus and allowed to dry at first for four or five days in the shade and finally in the sun. It is prepared by the middle and upper classes of Hindus for domestic use and is not sold in the bazar. The sticks of kaya khair are about 6 inches long by one inch in diameter.

Bombay cutch.

Bombay cutch.—Catechu in balls. This form consists of balls about as large as an orange, very hard and heavy, of a ferruginous aspect externally, brittle and black internally. Another form occurs in a flattened condition; the cakes originally, in all probability, globular, and of about the same dimensions, but pressed out of shape before being perfectly dried. The globular form is made in Kanara and, according to Dr. Hamilton and Major Mackintosh, on the Malabar coast of which Bombay is the entrepôt.

Sir George Birdwood in "Bombay Products" describes four kinds of Bombay cutch—

(1) Kanchu or Dharwar, flat, round cakes, two inches in diameter and one inch thick; dark brown in colour, and preserved in bájri husks.

(2) South Konkan, covered with paddy husks.

(3) Khandesh, in angular grains, pale earthy brown internally, darker externally.

(4) Surat, in irregular lumps of a light brown colour, from the size of a hazel-nut to a walnut. This is the *katha suffaid*, the pale or white catechu of Bombay. CUTCH TRADE-FORMS.

The following is a brief description of the various samples of cutch exhibited in the Indian Museum and submitted to analysis :— Specimens examined.

336. Cutch, Forest Officer, Surat, Bombay.	Small lumps about 1 inch across, flat on one side, brown externally, dull fawn within; fracture earthy, showing white spots.
342. Cutch, Forest Officer, Nasik, Bombay.	Ditto ditto.
887. Prepared cutch, Forest Officer, Tharrawady Division, Pegu Circle, Burma.	Dark chocolate, dense fragments.
888. Ditto ditto.	Nearly black, shining fracture.
889. Sha, ditto ditto.	Ditto ditto.
896. Cutch, ditto ditto.	Similar to 887.
1436. Cutch, Forest Officer, Kumaon, North-West Provinces.	Dark brown outside, light brown within; fracture earthy with laminated structure.
2344. Soft cutch, Conservator of Forests, Tharrawady Division, Pegu Circle, Burma.	Ditto ditto.
2345. Hard cutch, ditto ditto	Black irregular masses with shining fracture and air spaces.
2346. Ditto, Conservator of Forests, Yaw Division, Pegu Circle, Burma.	Ditto ditto.
2347. Soft cutch, ditto ditto	Very dark brown shining masses with reddish dust.
2348. Black cutch, Conservator of Forests, Minbu Division, Pegu Circle, Burma.	Similar to 1436 in appearance.
2349. Yellow cutch, ditto.	Dark reddish-brown or chocolate cakes.
2350. Red cutch, ditto.	Reddish-brown, dense, irregular and dull fracture.
3361. Cutch, Assistant Conservator of Forests, Kamrup, Assam.	Black and reddish-brown, irregular fracture.
3362. Ditto ditto	Black shining masses with porous structure.
3391. Cutch, Pegu No. 1, Burma, from Calcutta market.	Brownish-black, shining fracture; covered with smooth leaves.
3592. Ditto No. 2, Burma, from Calcutta market.	Dull brown, like 'clinkers,' containing visible impurities.
3393. Cutch No. 1 *var.* Tela (Mansarami), from Calcutta market.	Dull earthy brown, containing visible impurities.

CUTCH TRADE-FORMS.

Specimens examined.

3394. Cutch No. 1, Janakpuri, from Calcutta market.	Stratified masses showing black, chocolate and light brown layers.
3395. Cutch No. 2, Janakpuri, from Calcutta market.	Ditto ditto.
3396. Cutch No. 3, Janakpuri, from Calcutta market.	Ditto ditto.
3397. Cutch *var.* Tela (Telengar), from Calcutta market.	Black coloured masses with whitish earthy covering, and lustrous fracture.
3400. Cutch *var.* (Chaukhabi), from Calcutta market.	Brownish-black, dense lumps with leaf impressions.
3401. Cutch (Salpatawala), from Calcutta market.	Rectangular slabs 6 × 3 inches, dark reddish-brown or chocolate in colour with leaf impressions.
3413. Black cutch, Conservator of Forests, Pegu Circle, Burma.	Blackish cone-shaped pieces; fracture lustrous.
3428. Yellow cutch, ditto	Flat cakes of about 1⅛ inch diameter, light yellowish-brown outside and reddish-brown within; fracture brittle, lustrous and porous.
5029. Cutch, Conservator of Forests, Seoni Circle, Central Provinces.	Blackish-brown cakes 2″ square by ⅛″ thick. One side with earthy impurities, as if dried on soil.
5805. Cutch, from Calcutta market.	Dark reddish-brown; fracture shining.
6143. Cutch, Deputy Conservator of Forests, Palamau Division, Bengal.	Square or oblong cakes, 2″ × 2″ or 2″ × 3″, shining dark brown stratified inside with light brown.
6144. Ditto ditto .	Dull blackish masses.
6145. Ditto ditto .	Shining black masses, porous; impurities present.
7806. Extract prepared in Glasgow by vacuum process.	Coal-black extract; shining fracture.
9065. Catechu tannin, from Conservator of Forests, School Circle, Dehra Dún.	Black extract with conchoidal fracture.
9066. Catechin, ditto ditto .	Light pinkish-brown masses with earthy friable fracture.
10084. Extract, Tezpur, Assam .	Brownish-black cakes, uniform, and shining fracture.
10330. Ditto, Inspector-General of Forests.	Brownish-black, porous shining pieces.
10580. Ditto, Deputy Conservator, S. Circle, Cent. Provs.	Dull brownish-black; fracture stratified.
11036. Ditto, Conservator of Forests, W. Circle, Upper Burma.	Reddish-black uniform; fracture conchoidal.
11844. Ditto, Divisional Forest Officer, Kanara, W. Division.	Balls with ashy white surface, blackish brown within.

CUTCH TRADE-FORMS.

Specimens examined.

11979. Black cutch, Director, Land Records and Agriculture, Burma.	Brownish-black, shining, somewhat porous, wrapped in leaves.
13033. Kumaon, Director, Land Records and Agriculture, United Provs.	Small oblong cake, light brown, fracture stratified.
13783. Madras, through Board of Revenue.	Brownish-black, porous, leaf impressions.
14405. Bombay-Burma Trading Corporation, Ld.	Oblong cakes 2″ × 6″ × 1″, brownish-black, porous, reddish-brown when scratched.
16951. Hard cutch, Deputy Conservator, Depôt, Agency Division, Rangoon.	Reddish-brown to blackish-brown, enveloped in leaves.
16959. Soft cutch, Deputy Conservator, Pakokku, Burma.	Brownish-black uniform, slightly porous.
16960. Hard Cutch, ditto ditto .	Brownish-black, uniform, dense.
16961. Superior cutch, ditto .	Dark reddish-brown.
17058. Deputy Conservator, Bahraich.	Dark reddish-brown lumps of about a pound in weight.
17933. Yellow cutch, Pegu Circle, Burma.	Reddish-brown cakes.
19794. Ditto, Mandalay, Burma	Brownish-black, porous, shining.
19842. Ditto, Angul Division .	Dense chocolate-like masses.
21383. No. 1, Deputy Conservator, Southern Shan States, Burma.	Conical lumps like pastiles, 1½ inch long, light reddish-brown.
21383-1. No. 2, ditto ditto . .	Square or oblong cakes 1″ × ¼″, light reddish-brown.

CHEMICAL COMPOSITION.

Chemical Composition.—The active astringent principles of cutch are a tannin formerly known as catechu-tannic acid and a crystalline body named catechin. The value of cutch as a dyeing and tanning agent depends upon the amount of these two substances, while at the same time they are a measure of its suitability as a medicine.

Davy, 1803.

Sir Humphry Davy in 1803 was one of the first to investigate the chemical properties of catechu, and his results were communicated to the Royal Society of London in a paper, entitled "An account of some experiments and observations on the constituent parts of certain astringent vegetables: and on their operation in tanning." By Humphry Davy, Esq., Professor of Chemistry in the Royal Institution. The paper was communicated by the Right Honourable Sir Joseph Banks, Bart., K.C.B., P.R.S., and was read February 24th, 1803. (Philosophical Transactions, Volume 93, 252.) In the third section of his paper he discusses his experiments and observations on "Catechu or Terra Japonica." The material was rightly described as an extract from the wood of a species of Mimosa (the

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former name for Acacia) found in India. There were two kinds of extract known in England at that time, one from Bombay of a uniform texture and of a red-brown tint, and the other from Bengal of a paler and more friable character and with a fracture presenting strata of chocolate and red-brown colours. It may be of interest to quote Davy's analyses of these two samples.

	Bombay.	Bengal.
Tannin	54·5	48·5
Extractive matter	34·0	36·5
Mucilage	6·5	8·0
Residue, chiefly sand . . .	5·0	7·0
TOTAL .	100·00	100·00

The tannin was estimated by precipitating the infusion with a solution of gelatin and weighing the compound. In the "extractive matter" was recognised what we now know as catechin, by its sweet and astringent taste, its greater solubility in boiling than in cold water, and the colour of its solution turning red on exposure to the air. Davy observes that the pale catechu is that most sought after in India, and the peculiar sweetish taste of the extractive matter (catechin) which it contained probably rendered it so agreeable to the Hindus for the purpose of chewing with betel nut.

Napier, 1875.

In a "Manual of Dyeing," James Napier (1875), there are given analyses of samples of catechu in the European market derived from Bombay, Bengal and Malabar. The Bombay sample yielded 52 per cent. of tannin, Bengal 49·5 and Malabar 45·8 per cent. The balance is returned as gum, extractive and colouring matter and impurities.

Analyses by Prof. Proctor.

To ascertain if there was any uniformity in the composition of cutch, I applied to Professor H. R. Proctor of Leeds, and he obligingly placed at my disposal the following analyses of extracts from **Acacia Catechu**:—

	Tanning matter.	Non-tanning matter.	Insoluble.	Water.
Dark Cutch . . .	58·9	1·0	19·1	12·0
White cutch of kath . .	72·2	5·8	6·8	14·2
Yellow cutch, Pegu, Burma .	69·2	8·0	10·4	12·4

CUTCH, CHEMISTRY OF.

Professor Proctor also forwarded some figures of recent analyses of extracts which were supposed to be derived from **Acacia Catechu.**

Analyses by Prof. Proctor.

Mark.	Tanning matter.	Non-tanning matter.	Insoluble.	Water.	Tanning on dried extract.
Drysdale . .	42·2	25·6	7·6	24·6	55·8
Salatiga . .	30·8	29·7	2·2	37·3	49·1
B. B. Flag I .	62·6	12·0	10·0	15·4	73·9
B. B. Leurel II .	59·6	15·5	7·6	17·3	72·0
B. Star 3 . .	46·5	23·2	14·9	15·4	54·9
41 . . .	41·5	17·6	4·6	36·3	65·1
42 . . .	29·6	18·8	31·1	20·5	37·3
Pegu . . .	30·0	35·4	0·7	24·9	39·9
Assam . . .	46·4	34·3	2·7	16·6	55·6
Ame . . .	45·7	19·8	15·8	18·7	56·2

Analyses made in Calcutta.

The following tables give the result of the analyses of several samples of cutch exhibited in the Indian Museum. Their appearances have been described on pages 37 to 39 :—

Indian Cutch.

	Water.	Tannin.	Catechin.	Non. Tan. sol.	Insol. org.	Ash.	Spirit extract.
336 Surat, Bombay . . .	14·0	37·0	16·0	28·9	2·5	1·6	77·8
342 Nasik, „ . . .	13·4	37·4	15·6	26·8	4·0	2·9	78·5
11844 Kanara, Bombay . . .	11·6	39·8	3·9	34·7	4·5	5·5	60·7
1436 Kumaon, United Provinces .	12·0	42·9	33·0	3·2	2·6	6·3	67·3
13033 „ „ „ .	14·1	39·1	40·8	...	2·5	4·9	78·8
3393 Tela, Mansarami, United Provinces	9·7	17·3	1·7	29·8	14·0	27·5	27·0
3394 Janakpuri No. 1, United Provinces	13·0	40·7	16·8	24·0	2·8	2·7	68·9
3395 Janakpuri No. 2, United Provinces	13·5	36·8	17·3	28·4	3·5	1·5	69·6
3396 Janakpuri No. 3, United Provinces	12·5	38·8	17·2	26·4	3·3	1·8	75·1
3397 Telangir, United Provinces .	8·0	30·1	2·0	29·6	4·6	25·7	49·0
3400 Chaukhabi, United Provinces .	9·2	27·6	4·5	22·8	9·6	26·3	45·8
3401 Salpatawala No. 3, United Provinces	8·0	15·2	4·0	25·2	9·3	38·3	32·0
9065 Catechu-tannic acid, United Provinces, ...	11·7	43·3	2·5	32·5	4·9	5·1	55·6
9066 Catechin, United Provinces .	13·3	8·7*	36·8	10·9	20·4	9·9	59·6
17058 Bahraich, „ „ .	11·5	40·2	13·4	29·8	1·1	4·0	80·0
5029 South Circle, Central Provinces .	11·9	30·3	12·3	33·7	5·2	6·6	67·7
10580 „ „ „ „ .	11·1	29·7	12·0	35·0	6·8	5·4	57·7
6143 Palamau, Bengal . . .	12·8	36·4	18·3	19·3	5·5	7·7	68·1
6144 „ „ . . .	10·4	29·5	3·4	33·4	5·6	18·7	32·0
6145 „ „ . . .	10·7	33·1	1·2	36·7	3·7	14·6	43·6
19842 Angul, Bengal . . .	12·1	46·0	4·5	31·2	1·5	4·7	60·0
3361 Kamrup, Assam . . .	10·7	50·0	9·7	23·1	4·3	2·2	80·0
3362 „ „ . . .	11·0	45·2	2·8	34·9	2·8	3·3	66·0
10084 Tezpur, „ . . .	11·6	42·5	11·6	26·0	5·4	3·5	77·9
13783 Madras	12·5	45·5	5·6	29·6	2·9	3·9	69·5
89781 Kurnool, Madras . . .	13·0	45·0	3·5	31·8	2·2	4·5	62·0

* Estimated by another method, tannin by hide-powder . 34·8

Burma Cutch.

CUTCH, CHEMISTRY OF.

Analyses made in Calcutta.

		Water.	Tannin.	Catechin.	Non. tan. sol.	Insol. org.	Ash.	Spirit extract.
887	Tharrawaddy	11·8	46·1	5·2	33·0	2·0	1·9	77·8
888	„	11·9	48·6	5·5	28·3	3·2	2·5	76·0
889	„ "Sha"	12·3	44·5	12·6	25·8	2·6	2·2	69·0
896	„	10·9	54·6	3·6	26·3	2·2	2·4	76·9
2344	„ Soft	10·5	50·2	4·6	28·5	4·1	2·1	75·5
2345	„ Hard	10·1	49·7	2·8	31·0	3·0	2·4	73·0
2346	Yaw Division, Hard	11·5	40·4	2·2	40·0	3·1	2·8	62·0
2347	„ „ Soft	10·3	46·8	2·4	37·2	1·5	1·8	71·6
2348	Minbu, Black	7·2	19·4	10·1	10·0	3·7	49·6	30·3
2349	„ Yellow	11·2	41·7	5·8	38·2	·4	2·7	62·7
2350	„ Red	11·4	45·5	5·1	33·4	·7	3·9	70·7
3391	Pegu, No. 1	11·5	48·2	2·1	32·7	3·4	2·1	69·1
3392	„ No. 2	9·5	19·7	...	28·5	14·2	28·1	32·3
3413	„ Black	10·9	40·2	...	44·9	1·9	2·1	69·7
3428	„ Yellow	11·2	42·6	13·6	30·4	·4	1·8	73·5
5805	Burma (Calcutta Bazar)	10·7	44·3	3·5	34·1	1·9	3·5	66·3
7806	Vacuum made	10·9	48·9	...	34·9	1·9	3·4	68·8
7964	Old sample	8·4	14·1	2·6	26·1	12·0	36·8	23·7
10330	Pegu Cutch	10·5	44·2	6·8	32·3	3·6	2·6	68·5
11036	W. Circle, Upper Burma	11·4	47·5	2·5	33·5	3·5	1·6	70·0
11979	Black Cutch	10·6	45·7	2·4	35·3	3·7	2·5	67·0
14405A	Rangoon	11·5	40·1	4·0	40·0	2·6	1·8	69·0
14405B	„	10·6	46·2	5·9	42·1	3·3	2·5	75·0
14405C	„	11·6	43·7	4·3	35·6	2·0	2·8	63·0
14405D	„	11·0	41·4	3·3	37·6	2·9	3·8	69·8
14405E	„	12·0	31·8	1·1	35·9	6·6	12·6	47·4
16951	„ Hard	11·6	43·2	2·2	38·1	1·3	2·8	67·4
16959	Pakokku, Soft	11·4	47·2	1·8	34·5	2·4	2·7	62·0
16960	„ Hard	12·9	52·2	2·4	28·2	2·2	2·1	68·5
16961	„ Superior	11·3	54·8	4·8	25·2	1·3	2·6	72·2
19794	„ Mandalay	11·5	38·7	9·4	33·5	2·8	4·1	58·2
21383	Shan States	13·6	35·6	8·9	37·5	2·0	2·4	64·8
21383-1	„ „	14·1	33·5	13·2	35·1	1·1	3·0	62·5
25327	Rangoon (vacuum made)	11·2	41·0	11·7	33·1	1·1	1·9	72·1
	Average of 31 good samples	11·4	44·3	5·0	34·0	2·4	2·9	70·0

Methods of analysis.

The methods employed in examining these samples may be briefly stated.

The tannic acid or tannin was estimated by hide-powder. The prepared hide-powder was digested with chrome alum and washed till free from sulphates and strained. The moist hide was then mixed with a measured quantity of tannin liquor previously prepared by hot water, and shaken together, until the tannin was absorbed from solution. The weight of total solids of an aliquot part of the liquor compared with that of the original extract gave the amount of tannin. It was noticed that catechin although not precipitated by gelatine is absorbed by the surface of hide. It is somewhat misleading to regard the tannin recorded in the above tables as pure as in several cases they include some, if not all, of the catechin.

The catechin was estimated by powdering a weighed quantity of the cutch with pumice and digesting in acetic ether for twenty-four hours. The extract was evaporated to dryness, a small quantity of hot water added and crystals left to form. After standing for one

CUTCH, CHEMISTRY OF.

Method of analysis.

or two hours the crystals were collected on a filter, washed and weighed. This method adopted by Greshoff in estimating gambier gave excellent results when only one or two per cent. of catechin was present, and ensured the minimum amount of decomposition.

The organic matter insoluble in hot water, the ash and moisture were determined in the usual way. The figures for non-tanning soluble matter were calculated by difference.

As might be expected there is a greater variation in the composition of samples obtained from different sources in India than there is in trade samples of cutch imported into England. The tannin in these tables ranges from 14·1 to 54·8 per cent., and the catechin from nothing to 40·8. The lower valuations are due to the impurities present either added through carelessness or fraud or to improper manufacture. When the mineral matter constitutes one quarter, one third and one half of the extract, there is evident adulteration, and such extracts can have little value, either as a dye, a medicine or a masticatory.

Variation in amount of 1. Tannin, 2. Catechin, 3. Mineral, matter.

There is no rule respecting the relation between the tannic acid and catechin. In the Burma samples there is an average ratio of 9:1, while in the Indian samples the ratio extends from 1:1 in the Kumaun samples to 28:1 in a Rangoon cutch. The variations that may be expected in manufacture may be conveniently studied in observing the composition of the "Catechu-tannic acid" and "Catechin" (9065, 9066), prepared by separating the crystalline and non-crystalline portions of a batch of ordinary Oudh cutch.

Ratio of tannic acid to catechin.

There is a remarkable similarity of composition in ten of these samples, where a rather high amount of catechin is associated with a low amount of tannin. These include specimens from Surat and Nasik in Bombay, the Janakpuri cutches, Bahraich in the United Provinces, the Central Provinces, Palamau in Bengal, Tezpur in Assam and the Shan States in Burma. Although so widely distributed they exhibit an average of 37 per cent. of tannin and 15 per cent. of catechin or a ratio of 2·4:1. They hold therefore an intermediate position between the ordinary commercial cutch of Burma and the crystalline cutch of Kumaon and are probably yielded by the trees botanically referred to as **A. Catechu** and **A. Sundra**.

Mucilage.

Under the head of "non-tanning soluble matter" must be included mucilage or gum of the arabin class. This was detected by examining the residue left after exhausting the cutch with alcohol. The residue soluble in water was precipitated with alcohol two or three times until free from colouring matter, when it gave the reactions for gum arabic with the usual tests.

In some samples of cutch giving much non-tanning matter caramelised products due to decomposition of the tannic acid were regarded as the ingredients.

Sugar.

Allen records the presence of 0·5 per cent. of sugar in a sample of cutch. In one of the Janakpuri specimens I obtained as much as 1·2 per cent.

CUTCH, ADULTERATION OF.

Adulterants of cutch.—In dealing with the composition of cutch it is necessary to allude to the various substances which are occasionally added to adulterate it. Mr. Braithwaite of the Forest Department mentions the decoction of the bark or wood of the following trees which are sometimes used in Burma to mix with it. (*Indian Forester*, 1895.) *Thaw* (Terminalia Oliveri), *sundaw* (Terminalia tomentosa), *hnu* (Terminalia bialata), *hnangè* (Terminalia Chebula), and to a less extent *pyinkado* (Xylia dolabriformis) and *pyoung* (Lagerstrœmia Flos-regina). Also *ngadè* (Odina Woodier), according to Mr. Corbet. All of these barks are more or less astringent and according to our present knowledge would be considered substitutes rather than useless adulterants of a tannin extract. For instance, the extract of the bark of Terminalia Oliveri has been shown to be very rich in tannin. Professor Dunstan obtained 68·27 per cent. of tannin in the dried extract, and Professor Procter of Leeds found the tannin to agree in its reactions with that from the wood of Acacia Catechu. Professor Hummel, however, reported that the colouring matter was inferior and when submitted to the test of calico printing it gave very poor results. It is, therefore, more suitable as a tan than a dye. Where the tree is plentiful along the Irrawaddi below Zigyang, the fishermen employ the extract to colour their nets.

By mixing barks.

Re-melting in Rangoon.

Chinese brokers in Rangoon who have nearly all the trade in their hands, do not own to this adulteration, but they confess that they re-melt soft cutch, mixing it with hard cutch, and re-pack it in boxes. This is probably the time at which adulteration takes place, as it is extremely easy to incorporate all manner of impurities into a soft black extract. It has been reported that for three years an individual in Burma carried on a lucrative trade by purchasing pure cutch in the district and boiling it up again with 25 per cent. of godown sweepings. This was said to fetch as high a rate in the home market as the best cutch shipped from Burma.

Rubbish mixed in.

Allen states that cutch is not infrequently adulterated with starch, sand and blood among other materials, and Jessart reports that he has met with an admixture of 60 to 70 per cent. of ferrous carbonate. The *silpatsuah* cutch, however, contains red earth as a recognised ingredient.

In the foregoing tables of analyses a large amount of mineral matter preponderates in a few of the specimens. In the Indian samples 6 in the 24 or 25 per cent. would be rejected for this reason alone, but in the Burmese samples only 3 in 34 or 8·8 per cent. were unduly loaded with ashes.

Tests.

To test for adulterants.

A very simple test, besides the estimation of tannin and catechin, is the solubility of catechu in 90 per cent. alcohol. This is readily performed by digesting one or two grams of the finely

CUTCH, ADULTERATION OF. To test for it

powdered drug with occasional shaking for 24 hours. The solution is then filtered, the marc washed till free from colour, and the whole extract evaporated to complete dryness at 100° C. In glancing through the tables of analyses it is observed that the average dried alcoholic extract is 70 per cent.: some fair samples of cutch yield between 60 and 70 per cent., while those of undoubted inferiority contain less than 50 per cent.

In the German Pharmacopœia the above test is directed to be applied in a different manner. It requires that the residue remaining after extracting catechu with alcohol should not exceed 15 per cent. This figure, allowing for 15 per cent. of moisture, is equivalent to 70 per cent. of dried extract. But K. Dieterich, in 1901, pointed out that this requirement is too stringent, and recommended 30 per cent. as the limit of insoluble residue. He discovered that the residue from six samples of Pegu catechu varied from 25·71 to 41·86 per cent. His opinion therefore was that catechu conforming to the present official requirement was rarely found in the market.

In the light of the examination of over sixty samples of Indian catechu it is clear that the limitation of the Indian and Colonial Addendum of the British Pharmacopœia, *viz.*, 80 per cent. of extract, is too high, and that these figures might be altered to "between 60 and 70 per cent."

With regard to the ash limit of catechu the Indian and Colonial Addendum fixes the maximum at 6 per cent. and the United States Pharmacopœia at 5 per cent. Since the average percentage of the ash of a large number of samples of Burmese cutch was found to be only 2·9, there should be no difficulty in obtaining commercial cutch with less than 5 per cent. of mineral matter.

CATECHU VERSUS GAMBIER. Chemical differences.

The relation between catechu and gambier.—So far we have been dealing with catechu or cutch, an astringent extract made from the wood of **Acacia Catechu**. In the Malay States and Borneo there is manufactured an extract from a plant called **Uncaria Gambir**. This has similar properties, and it has often been reported that the chemical composition of the two substances is identical as they both contain tannic acid and the crystalline principle catechin. The catechins separated from these two plants were for many years considered the same, but A. G. Perkin (*Journal of the Chemical Society*, XXIII., 1904, 746), after studying their derivatives, has observed certain differences. He points out that gambier catechu contains a catechin $C_{15}H_{14}O_6$, melting at 175°—177°, the pentabenzoyl derivative of which melts at 151°—153°, while the catechin of **Acacia Catechu** $C_{15}H_{14}O_6$, melting at 204°—205° gives a benzoyl compound melting at 181°—183°. Notwithstanding these minor differences the researches of Perkin and Yoshitake, and Kostanacki Tambir and Krembs show that there is an extremely close chemical relationship between the catechins derived from different sources. Attention should be drawn to the interesting fact in vegetable physiology that the extract of the wood of a leguminous

CATECHU VERSUS GAMBIER.

tree has such a remarkable resemblance to the extract made from the twigs of a rubiaceous shrub.

Analyses of Gambier.

Analyses of gambier according to Proctor shew a tannin content of 36 to 40 per cent. Allen records a percentage of 47·18. M. Greshoff, Haarlem, has recently (1905) given the following results of an analysis of an unadulterated gambier: Tannin 24, crude catechin 46, crystalline catechin 30—35, insoluble 7·6, water about 15, ash not more than 5 per cent.

The following two analyses are given of pale cube gambier as sold in Indian bazars, and they are comparable with the tables of analyses of cutch given on page 41 :—

	Water.	Tannin.	Catechin.	Non. tan. sol.	Insol.	Ash.	Alcoholic extract.
Calcutta .	11·4	27·7	30·0	19·9	7·1	3·9	79·9
Bombay .	13·5	32·4	18·2	22·9	9·4	3·7	77·4

They therefore approach in composition the Kumaon and Janakpuri cutches of Northern India.

To distinguish the two.

As a means of distinguishing between catechu and gambier, Dieterich in 1896 recommended the following fluorescent test: 3 grams of gambier are dissolved in 25 cc. normal caustic potash and 100 cc. of water, 50 cc. benzene (·700) are then added and the whole agitated in a separating funnel. On allowing it to stand the upper benzene layer shows a green fluorescence. **Acacia catechu** does not show this reaction.

Similar uses in the East.

Notwithstanding the minor differences between the two extracts as a practical manner, cutch and gambier are used for similar purposes in the arts and in medicine. Evidence of this is traced in the history of gambier manufacture in Malaya. For several years the Malayas used *cate* or cutch, the product of the Indian **A. Catechu,** to chew with betel nut, but this became too expensive and they had to resort to various substitutes. Before 1750 they discovered the way of making cakes of the extract of the gambier plant, and this extract has now almost entirely displaced Indian cutch in the Straits Settlements and elsewhere in the Far East.

In the Calcutta bazars Janakpuri khair (cutch) and *papri khair* (gambier) are sold side by side in all the grocers and druggists' shops. The first is somewhat darker and is considered more bitter than the imported gambier, and the retail price is somewhat higher. The preference which is shown for one kind would seem to be merely a matter of taste for the consumer and a question of cost for the buyer.

Prepared catechin.

Catechin is sometimes prepared locally from cutch and gambier for edible purposes mixed with betel nut. In Calcutta the moist crystals are sold as *gala khair*. This is prepared by taking two parts of Papri and one part of Janakpuri, boiling them in water and straining through a cloth when cold. The residue on the cloth, after pressing, is kept for sale. The eaters of *pán* thus sometimes prefer an article almost entirely free from tannic acid.

Catechu in medicine.

CATECHU VERSUS GAMBIER.

Catechu from **Acacia Catechu** was recognised as an official drug in the London Pharmacopœia of 1721. The first British Pharmacopœia of 1864 included both catechu and gambier, the former being called **Catechu nigrum** and the latter **Catechu pallidum**. The inclusion of the two drugs was considered unsatisfactory as pharmacists were left to use whichever they pleased in making the infusion, tincture and compound powder. Professor Bentley pointed out that the infusion and tincture would vary, especially in colour, according to the kind of catechu employed, and this would lead the patient to the belief that his medicines had been wrongly prepared. With deference to this opinion Black catechu was discarded in subsequent editions of the British Pharmacopœia, and the Pale catechu was retained. In the Pharmacopœia of India, 1868, Black catechu is described and is prescribed for the preparation of the infusion, tincture and compound powder. In this work Pale catechu is described to be used for making catechu lozenges and is said to possess the advantage of being more soluble than Black catechu though the properties are similar. In the Indian and Colonial Addendum (1900) to the British Pharmacopœia, Black catechu or **Catechu nigrum** is again promoted to an official position and is directed to be employed in making all the preparations.

In medicine.

In the United States, Black catechu until recently has been preferred to Pale catechu. In the 16th edition (1889) of the Dispensatory of the United States the extract of the heart-wood of **Acacia Catechu** is referred to as "proper catechu," and gambier is placed among the catechus not recognised by the United States Pharmacopœia. The editor then proceeds to describe in detail the varieties of the official catechus to be found in the market of Philadelphia and designated as Plano-convex catechu or cake catechu, Pegu catechu, catechu in quadrangular cakes, Pale catechu and catechu in balls.

In the United States Pharmacopœia for 1900 gambier, or as it is called gambir, replaces catechu of the Pharmacopœia of 1890. The authors of the National Standard Dispensatory state that catechu is official in nearly all pharmacopœias though all do not agree in specifying this substance. The name catechu is retained for it. In America we are informed that very little catechu from **Acacia Catechu** is now to be found in the market, showing that an entire change of opinion with regard to Black cutch has established itself.

Areca Catechu.

EXTRACT OF ARECA-NUTS.

Former writers on Indian cutch have occasionally referred to an extract made from the nuts of **Areca Catechu** and used as a masticatory, but there is very little evidence to show that this extract

EXTRACT OF ARECA-NUTS.

is a marketable article at the present time. Ainslie (*Materia Medica*, Vol. I., 65) describes two substances said to be prepared from the betelnut palm: the first was of a light brown colour called *cutta-camboo* and brought from Pegu, the second was of inferior quality, almost black in colour, called *cushcuttie* and imported from Acheen. These were no doubt confounded with Pegu cutch and gambier. B. Heyne (*Tracts Historical and Statistical on India*, 1814) gives a circumstantial description of the manufacture of an extract from **Areca Catechu** in Mysore. Two products were obtained, one with a yellowish-brown colour and earthy fracture and the other, called *kassu*, of a black colour and mixed with impurities. Pereira (Vol. II., Part II., 341) gives Heyne's account of the origin of *kassu* and speaks of it as a product of Ceylon. In a letter from an Assistant Surgeon in Colombo in the year 1838, *kassu* is more properly supposed to be derived from **Acacia Catechu** and produced in India. Mohideen Sheriff made an unfounded assertion when he suggested that the cutch of South India was made from areca nuts. On the other hand, Blume who had a wider experience denies (*Rumphia* II., 67) that an extract such as catechu is procured from the nuts. Baden-Powell in "Punjab Products" alludes to an extract called *kossa* made from areca, and it is said that a sticky extract used for varnishing wood is sometimes prepared in Bombay, but there is no definite information now existing regarding the manufacture.

Made in Mysore.

Made in the Punjab.

There is no doubt that in former times much confusion existed with regard to the so-called extract of areca, and among some the confusion still exists. About a year ago a sample of cutch labelled **Areca Catechu** was sent from Madras to the Reporter on Economic Products for valuation, and from its appearance and composition, especially in its yield of catechin, it possessed all the characters of cutch from Burma. From other descriptions of cutch sold in Madras, it appears that Burmese cutch is now largely supplied in the shops.

Burmese cutch in Madras.

A sample of extract of **Areca Catechu** in the Indian Museum, designated as *Pakku*, was obtained from Trivandrum, Travancore. It has the dark-brown appearance of ordinary cutch, affords 40 per cent. of tannin, but no catechin, and yields only 49·2 per cent. of alcoholic extract. It, therefore, differed in some respects from ordinary cutch, and its origin is being enquired into. It seems highly improbable that these nuts could be used for the purpose of making an extract, considering the price of betelnuts in the market, and the demand that always exists for them in the raw and prepared state. They are habitually eaten with ordinary forms of cutch and gambier, and sometimes they are prepared by steeping them in a decoction of the cutch and allowed to dry, but at present we know little about the relative composition of the numerous trade samples of **areca**, and the whole subject is worthy of investigation.

Areca extract made in Madras.

Trade Statistics.

TRADE IN CUTCH.

A few references to the production and export of cutch and gambier will throw much light on the future of their respective markets. Gambier holds a firm position and is exported to double the extent of cutch, while the latter is falling off in production and trade with foreign countries.

Indian cutch is manufactured principally in Burma and about 97 per cent. of the exports from British India are shipped from Rangoon. During the years from 1869 to 1872 the following amounts were exported to the United Kingdom :—

1869	1870	1871	1872
2,257	5,252	4,335	5,240 tons.

In 1869-70, 10,782 tons were exported from Burma valued at £193,602. In 1872 the value of the cutch imported into the United Kingdom was estimated at £124,458. Statistics of more recent times show that for the five years ending 1895-96 the average exports from British India were 190,450 cwts. (9,522 tons), valued at ₹34,12,842 (£227,522 16*s.*). For the five years ending 1904-05 the average annual exports were reduced to 82,692 cwts. (4,139 tons), valued at ₹14,77,132 (£98,475 9*s.* 4*d.*). The price per hundredweight is ₹17-12 (£1 3*s.* 8*d.*). Last year the United Kingdom took one-half and France one-sixth of the exports, while Germany, the United States, Holland, China and Ceylon took smaller quantities.

Trade in Gambier.

The trade in gambier is much larger than that of cutch. This article has been exported from Singapore for several years. In 1839 we find that over 5,000 tons were sent to England from this port. In 1872 the imports into England reached 21,000 tons valued at £451,737. Singapore exported in 1871 no less than 34,248 tons of gambier. In 1876 the amount rose to 50,000 tons, and in 1877 it fell to 39,000 tons. Recent statistics show that in 1903, 32,083 tons of block and 2,823 tons of cube gambier were sold at Singapore. In 1904, 22,246 tons of block and 2,563 tons of cube were sold and in 1905, 29,921 tons of block and 3,445 tons of cube. About 1,300 tons of gambier from the Straits is imported annually into India, chiefly at Calcutta, at ₹17-8 (£1 3*s.* 4*d.*) per cwt. or ₹356 (£23 14*s.* 8*d.*) per ton. This amount is almost entirely consumed in the country.

Conclusions.

CONCLUSIONS.

The foregoing notes deal with two products differing in botanical and geographical origin, yet having in many respects similar properties. They have long enjoyed a reputation in medicine and have rivalled one another in their claims for admission into the Pharmacopœias of western nations; the pale catechu or gambier is, however, now taking the lead as the favourite drug.

CONCLUSIONS.

The reasons for this are not far to seek. The khair tree (**Acacia catechu**) occupies reserved areas under the Forest Department in two or three centres in Burma, Kumaon in Northern India, and perhaps Bombay, and the manufacture is restricted owing to the limited number of trees available for felling. On the other hand, gambier is obtained from a crop the cultivation of which can be readily extended as the demand for the manufactured article increases, and the uniformity of composition and greater outturn of the product appeal favourably to purchasers. Indian cutch, especially that of Burma, has a standard of its own, and will continue to command a market on account of the high quality of the extract in tannin. By a system of natural reproduction in the forests in localities indicated in the above notes, and by careful attention to the manufacture, cutch of India should long remain a rival of the gambier of the Straits in dyeing and tanning industries and in medicine.

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—o—

PSOPHOCARPUS TETRAGONOLOBUS.

(GOA BEAN.)

GOA BEANS IN INDIA.

By I. H. BURKILL, *Officiating Reporter on Economic Products to the Government of India.*

THE GENUS PSOPHOCARPUS.

Its useful species.

In the genus **Psophocarpus,** Agriculture or Horticulture finds two serviceable plants; the one is **Psophocarpus palustris,** a plant widely cultivated in Africa and introduced into South America; the other is **Psophocarpus tetragonolobus,** which is cultivated from Mauritius to New Guinea. Possibly the whole genus is to be reduced to these two widely grown beans, which differ thus:—

Flowers on short stalklets, several—**P. palustris.**
Flowers on long stalklets, few, larger—**P. tetragonolobus.**

Both have been grown in India, but **P. palustris** is not grown now.

First report on P. tetragonolobus.

P. tetragonolobus was the first of the two to come to European knowledge. Rumpf who lived in Amboyna from 1653 to 1702, drew it and described it. "This Phaseolus gives" he says (Herbarii Amboinensis liber ix., cap. xxi., Amsterdam 1750; tab. cxxxiii.): "tuberous roots as well as edible beans. ... Its flowers are the largest of all the Phaseoli ... within pale blue, without dun-coloured: they are few and only open before midday, and do not produce much fruit. ... The beans are quadrangular, about a hand-span long, or sometimes a foot long, hardly a finger-breadth broad, with membranous frilled wings at the margins, pale green at first—then smoke-colour and hard. When old the pods have narrowed wings, quadrate, and at maturity they open in the sun with much crackling. ... The root ... has the form of an oblong

HISTORY OF PSOPHOCARPUS.

turnip. In Latin the plant is called Lobus quadrangularis, in Malay and the Javan language *Botor*, ... in the language of Banda *Culebet*, in that of Bali *Caloncan*. Botor is derived from the Arabian Batr which means a lobe ... The bean is produced in Amboyna and elsewhere apparently, in Java and Baleya, but is rarely cultivated.

"Its tender green pods, before they harden into the beans, are cooked, cut into short segments, like other such beans. ... The ripe beans can hardly be eaten, as they are said to make the head heavy. ... The root is eaten boiled and for the purpose is dug before the bean ripens, after which it is less pulpy and dry."

Linnaeus' name.

Rumpf's plant, which is figured, is undoubtedly **Psophocarpus tetragonolobus.** Linnaeus, when he came to range and catalogue all things known to have life, called it **Dolichos tetragonolobus.** Necker, who still had no more information than old Rumpf afforded, in 1790 changed the name to **Psophocarpus tetragonolobus,** which name we now adopt.

Origin of accepted name.

First record for China.

In 1790 Loureiro stated that it is grown in South China. It is not unlikely that he meant the neighbourhood of Canton. (*Flora Cochinchinensis*, p. 437.)

First records for India.

In 1799 according to Roxburgh it was introduced into the then twelve-years-old Botanic Garden of Shibpur, Calcutta, and it continued to be grown there for the Superintendent's table for some time (*vide* Roxburgh's *Hortus Bengalensis*, 1814, p. 55). Roxburgh did not know the native country of the bean, a circumstance which indicates surely that it had been grown in India before his time. Most likely Roxburgh obtained his seed in the first instance from local sources. It can also be proved to have been in cultivation at Madras about this time; for Wallich, who in 1828, distributed herbarium specimens from the Calcutta Botanic Gardens collected by Buchanan-Hamilton (in charge 1814-15) and by himself, also distributed specimens collected for him from Madras.

First record for Reunion.

In 1820 **Psophocarpus tetragonolobus** was in cultivation in the French island of Réunion (Breon, *Catalogue des plantes cultivées aux jardins botanique et de naturalisation de l'ile Bourbon*, p. 51). Breon did not know its origin; and this indicates that it had been in Réunion before the foundation of an experimental garden there. Had Breon received it from the Calcutta gardens, with which an exchange had been established, it would have been acknowledged.

Found in Burma.

In 1826 Wallich found the plant to be cultivated (or run wild) in Lower Burma.

First mention of P. palustris.

In 1825 Seringe, who wrote the account of the pea-family in DeCandolle's Prodromus, described Rumpf's plant, and remarked that Du Petit-Thouars had obtained a similar, but smaller plant from stream sides in Madagascar. This remark would seem to be the first mention of **Psophocarpus palustris.**

HISTORY OF PSOPHOCARPUS.

In 1826 Desvaux, stimulated by the work of Seringe to publish his observations on Leguminosæ, described **Psophocarpus palustris** from damp places in Senegal, West Africa, (*Annales des Sciences Naturelles*, Series i, ix, p. 420). The same plant was again described by Guillemin, Perottet and Richard in 1830 as **Psophocarpus palmettorum** (*Floræ Senegambiæ Tentamen*, p. 222) from specimens which they had obtained climbing up palm stems near Cape Verde, West Africa.

Second mention.

Third mention.

Mention has been made of Wallich's distribution in 1828 on behalf of the East India Company of the large herbarium then formed. Graham, the Professor of Botany at Glasgow, named Wallich's Leguminosæ and found both **Psophocarpus tetragonolobus** and **Psophocarpus palustris** among the specimens; but he did not at first recognise either, and named the one **Dolichos ovatus** and the other **Dolichos suffultus**. **Dolichos ovatus** was, however, almost immediately recognised to be **Psophocarpus tetragonolobus**.

Wallich had both species from India.

Graham did not recognise them.

Indian references 1832—1839.

The first important work after this date is Roxburgh's *Flora Indica*, in which (iii. 1832, p. 305) he contents himself by saying "**Psophocarpus tetragonolobus** is reared in gardens for the table, where indigenous I cannot say: ... we have an herbaceous variety from Pegu with esculent roots." It is astonishing that he does not give any vernacular name for the plant, as though he had not known one. In 1834 Arnott and Wight's *Prodromus Floræ Peninsulæ Indiæ Orientalis* was published. They describe the plant which was evidently familiar (to Wight at least) from gardens at Madras, but without giving any other information. In Graham's catalogue of the plants of Bombay, published after his death at Khandala in 1839, **Psophocarpus tetragonolobus** is said to be "cultivated in gardens and used like French beans" in the Bombay Presidency—"a native of Mauritius." It is impossible to find out if Graham had any evidence before him when he said that the plant had come from Mauritius. He gives no vernacular name.

In the Philippines 1837.

In 1837 Blanco (*Flora de Filipinas*, p. 576) wrote that the plant is grown round Manilla and eaten.

The first Indian vernacular name recorded is "Charakoni-Sem"—the familiar Bengali name:—it was recorded in 1845 in Voigt's *Catalogue of the Plants cultivated at Serampore and Shibpur*. Voigt runs wide of the mark when he suggests South America as its original home.

Hasskarl's account of the forms found in Java.

In 1842 Hasskarl studied these beans in Java. His work (*Flora*, xxv., *Beiblätter*, p. 75) is a new landmark. He found in Java that there were present both **P. tetragonolobus** and **P. palustris**, and that the latter had two varieties. But **Psophocarpus palustris** was not recognised by him as a

HISTORY OF PSOPHOCARPUS.

Forms found in Java.

described plant and consequently got the new name of **Psophocarpus longepedunculatus**. It, he records, was called by the natives "Djaat monjet" (monkey djaat); while the two varieties of **P. tetragonolobus** were called respectively "Djaat" and "Djaat Pütoi" (Parkia-like Djaat, because its pods were thought to be like those of the Parkia tree). Djaat is the long podded **Psophocarpus tetragonolobus**: Djaat Pütoi is narrow winged, hence Hasskarl's name of *var.* **micropterus.** He brought all into cultivation in the Buitenzorg gardens (*vide* his *Tweede Catalogus der in 'slands Plantentuin te Buitenzorg gekweekte gewassen*, Batavia, 1844, p. 281).

Hasskarl wrote of the variability in colour of the seeds in his *Plantæ Javanicæ Raroires*, 1848, p. 388.

Miquel's account in 1855 (*Flora van Nederlandsch Indie*, i, p. 181) is only a putting together of Rumpf's and Hasskarl's accounts.

The name Djaat Pütoi appears in Teijsmann and Binnendijk's Catalogue of the plants grown at Buitenzorg (*Catalogus plantarum quae in Horto Botanico Bogoriensi coluntur*, Batavia, 1866, p. 263) as Djaät peteui; and of both Djaat and djaat peteui we have three races named which differ in the colour of the seeds.

Djaat poetie—white seeds.
Djaat ietam—black seeds.
Djaat koenieng—yellow seeds.
Djaat peteui poetie—white seeds.
Djaat peteui ietan—black seeds.
Djaat peteui koenieng—yellow seeds.

Further confusion in names of P. palustris.

That most unfortunate plant **Psophocarpus palustris**, already with four names, obtained a fifth in 1858—**P. Mabala**—from the African traveller Welwitsch (*Apontamentos sobre a Flora de Angola*, p. 589) and later it seems again to have obtained another in **Psophocarpus comorensis** (Pierre in *Bulletin de la Société Linnéenne de Paris*, i, 1883, p. 380, and in Grandidier, *Histoire physique, naturelle et politique de Madagascar*, ii, 1886, plate 34). We can now dismiss it with a few further remarks. It has been found to be cultivated very widely in Tropical Africa. Welwitsch found it

Final remarks regarding P. palustris.

generally cultivated in Angola at a little distance from the coast, its seeds eaten fried in oil under the name of "Mabala" (*Hiern, Catalogue of the African Plants collected by F. Welwitsch*, i, 1896, p. 26): Speke and Grant found it in Mozambique; Sir John Kirk found it on the Zambesi; others have found it in Calabar, at Nupe, and on the Congo (*vide* Baker in *Oliver's Flora of Trop. Africa*, ii, 1871, p. 208). Baron says (*Journ. Linn. Soc. Bot.* xxv., 1889, p. 261) that it is common in both East and West Madagascar. Bentham in *Martius, Flora Brasiliensis*, xv, pt. i, 1859-62, p. 197, plate 52) shows that the plant has been taken to South America where it has long been established near the port of Bahia. Ito

(*Tentamen Floræ Lutchuensis*) says that it is cultivated in the Luchu Islands.

DISTRIBUTION OF P. TETRAGONOLOBUS.

Possibly it is a native of Madagascar carried thence westwards through Africa and to South America and eastwards to Malaya, but the evidence is slender as far as it goes at present, and the less said the better.

We have seen that it was once tried in Calcutta, but did not persist.

Psophocarpus tetragonolobus, the plant that we are more nearly concerned with, is not to be found on the continent of Africa. We have seen that before 1850 it had been noted to be in Réunion, India with Burma, Java and the neighbouring islands of Bali and Banda, also in the Philippines and Amboyna. Since 1850 it has been shown to occur in Mauritius, towards the western end of its distribution (Baker, *Flora of the Mauritius*, 1877, p. 79), and in New Guinea at the eastern (K. Schumann, *Flora von Kaiser Wilhelms Land*, p. 99; Schumann und Lauterbach, *Flora Deutsch Schützgebeit*, 1901, p. 372; Warburg, *Pflanzenkleid und Nutzpflanzen Neu Guineas*, 1899, p. 65). Safford records it from Guam 1,200 miles east of the Philippines, and peopled by a stock of Philippine origin. (Useful plants of Guam in *Contributions from the United States National Herbarium*, ix., 1905, p. 281.)

Usteri (*Beobachtungen über tropische Märkte*, 1905, p. 419) says that the bean is found in the markets of Java.

In 1862 Sir George Birdwood (*Catalogue of the Economic Products of Bombay*, p. 123) mentioned the plant as a Bombay product, fixing wrongly its home as Sicily upon an incorrect identification. He gives the Bombay names as Chandaree, and Charputtee, and the Cinghalese name as Dara-Dambala. Lisboa in volume xxv. of the Bombay Gazetteer, names the plant as Chowdari or Chevaux de frize of the French, describes it, and says loosely that "it is cultivated through Bombay and India."

WHERE GROWN IN INDIA.

As **Psophocarpus tetragonolobus** likes a considerable quantity of moisture it is most abundant in the damper parts of India. From the Panjáb it is almost absent, if not quite so. In the United Provinces it can only be got to ripen seed with some difficulty. The late Mr. William Gollan informed me that at Saharanpur it would make good growth during the rains, but would hardly bear more than a pod or two, and that it was lost to his garden some 15 years ago by not seeding.

United Provinces.

In the Central Provinces and Berar it is a little more at home, and can be found, but very rarely, in the village gardens. Sir George Watt collected it at Anjangaon in Berar in December 1894, and noted that it was only grown in a few villages. A little later Mr. F. G. Sly, Commissioner of Settlements, Central Provinces, who had it cultivated in the Government Garden, Nagpur, distributed it to the villages near

Deccan plateau.

PSOPHOCARPUS, WHERE GROWN IN INDIA.

Nagpur, and in 1903 its cultivation had extended beyond the district of Nagpur. In other parts of the Deccan plateau it is grown freely, as at Poona where large quantities come into the market and where with irrigation it is made to produce pods in the height of the hot weather (*vide* Woodrow, *Gardening in India*, ed. 3, 1899, p. 267). In Mysore according to information kindly supplied by Mr. J. Cameron, it is largely cultivated.

Bombay.

Under the Western Ghats the plant is abundant. Mr. R. P. Mehta, formerly Deputy Director of Agriculture, Poona, informed me that it is not uncommon in Gujarat. It is common in the Bombay market being grown near Bombay. It is also common around Ratnagiri, and common near Goa.

Bengal.

On the Eastern side of India, it occurs not very frequently in Bengal, but commonly enough near Calcutta to be a well known vegetable. The seeds are regularly sold by some of the native seedsmen of the city and every now and then pods are offered for sale in the New Market. If grown at all in the valleys of Assam, the fact is unknown to me. It is grown at Chittagong (see Prain, *Bengal Plants*, 1903, p. 391). I have not seen it under the Eastern Ghats, nor obtained any information regarding it from districts north of Madras. About Madras it is cultivated.

Madras.

Burma.

On the east coast of the Bay of Bengal it is to be found throughout Arakan. It is cultivated almost everywhere in Burma and very widely in the Shán States which supply the seed to Central Burma. Only in Burma it is a field crop: elsewhere it is always a garden crop.

The districts of Burma* in which the plant is most largely cultivated are:—Kyauksè, Mandalay, Meiktila, Yamèthin, Prome and Henzada. There is a very little of it in the Möng-mit Shán State which is administered as a division of the Ruby Mines District and a little in the Upper Chindwin Division and a little in Katha. In Hanthawaddy there is a little. In Tharrawaddy it is almost absent. Chinamen cultivate it on a small scale close to Rangoon. It is cultivated in tiny garden patches in Bassein. In Pegu it is found in gardens only. In Thatôn, it is more extensively grown by Karens on the banks of the Salween.

It is found in every village of the Hsipaw State (Northern Shán States) and on a fairly considerable scale in Hsumhsai Sub-State. In north and south Hsenwi it is fairly plentiful. It is grown in the large Kengtung State.

The sources of the seed supply in the Shán States are chiefly the villages of Kyauk-Khwet and Kywet-na-pa, near the borders of the

* The credit of getting together almost all the information that follows belongs to Mr. A. Gaitskell, I.C.S., formerly Director of Land Records and Agriculture, Burma.

PSOPHOCARPUS TETRAGONOLOBUS ITS NAMES.

Ye-Yaman tract of Kyauksè, and Nge-nin, also Maymyo which is in the Mandalay district though on the Shan plateau, Wetwun just east of Maymyo and Htilhaing in the Maw State (Myelat district, Southern Shán States).

Many of the names applied to **Psophocarpus** have an obvious meaning. I give them below as far as it is in my power :—

In Mauritius and Réunion : Pois Carré or Square pea.

In India.

Among the English, Goa bean.

Among the Portuguese at Goa, Fava de Cavallo or Horse Bean.

Bombay : Chandari (four winged).
Charputtee (four leaves).
Ghevda (meaning bean, at times meaning **Dolichos Lablab** only).

Bengal : Chara-koni-sem (four cornered bean).
Lakar-sem (stick bean).

Madras : Morisu-avarai (Mauritius Bean). *

Ceylon : Dara-dambala (four winged bean).

Burma : Pe-saung-sa (bean like **Averrhoa Carambola**).
Pe-myit (bean-root) is the root.

Karen hills : Kaw Bemya (Burmese bean).

Shan hills : Hto-pong (*i.e.*, the Pong-bean, pong may mean happy), the root being Ho-hto-pong.

In the Straits Settlements : Kachang Botol or Kachang Botor (Kachang means a bean, but Botol or Botor is not satisfactorily explained. The theory that Ridley quotes in Journ. Royal Asiatic Soc. Straits Branch, xxx., 1897, p. 114, that it comes from bottle is untenable ; Rumpf's speculation that it comes from the Arabic Batr seems far fetched).

In Java ; Botor Kachang and Djaät.

In Bali : Caloncan.

In Banka : Culibet.

In Amboyna : Botor.

In the Philippines and Guam ; Sequidillas, Camaluson, Calamismis, Pallam or Pallang.

No Indian names are old.

The evidence of language is against the bean being native anywhere within the Indian Empire. For none of the names given to it except Hto-pong (Shán) have any impress of age ; they are all

* Achard in his *1,500 Plantes d'Inde*, 1905, p. 366, says that the Pondicherry name is Mouroukouavarecody, which Mr. C. A. Barber assures me must be due to some misconception. The termination cody means 'climber.' The rest is Morisu-avarai misunderstood, or else Murukku avarai meaning 'crisped bean.'

ORIGIN OF PSOPHOCARPUS TETRAGONOLOBUS.

uncorrupted expressions of the modern language in which they are used. That it should be found wild in Burma proves nothing; for when wild it is certainly an escape from cultivation.

If it be agreed that the plant is not Indian, then how did it reach India? Possibly by two ways (1) through Goa from Mauritius or more likely from Rodriguez, the island near Mauritius of which the Portuguese made much use; and (2) almost certainly from the Malay Islands by the Malay Peninsula just as Manioc did (see *the Agricultural Ledger* No. 10 of 1904, p. 124). Economic products establish themselves in new countries more easily than their names: the Goa bean lost its Malayan names on reaching Burma and became the pea like a *Carambola* and the pea with a tuberous root, names which, however, it took with it to Arakan, where the long cultivated plants do not generally pass by common Burmese names. The Karens call it simply Burmese bean. Only the Sháns apply to it a name hard to explain.

Certainly not Indian.

Now the Sháns say that it came from Burma and the Burmese sometimes say that it came from the Sháns; but it is perfectly certain that neither the one nor the other know whence it came to their country. Possibly its field cultivation is more recent than its introduction into the country.

One may freely speculate as to whether **Psophocarpus** reached Mauritius or Rodriguez from Malaya, or Malaya from Mauritius or Rodriguez. There is only one point known to me that is useful for evidence, and that point is in the very probable African or Mascarene origin of **Psophocarpus palustris.** For if **Psophocarpus palustris** took its origin in Africa or the Mascarene islands or Madagascar, then probably the very similar **P. tetragonolobus** had an origin in the same part of the world.

Can it be Mascarene?

DESCRIPTION OF PLANT.

Psophocarpus tetragonolobus is an annual, of 8—9 months duration; after fruiting it dies. The tuberous root swells up very early; and when fruits are ripe it is already stringy and insipid.

The common plant in India has yellow-brown seeds. In Burma together with yellow-brown seeded plants, are white seeded plants. White seeded plants extend to Arakan but do not reach Bengal: I have also obtained white seeded plants from Hsipaw in the Shán States. Very dark brown seeds have been seen from Nagpur.

The Burmese distinguish two races, long podded and short podded. There is no great difference between them. The long podded in Burma is generally 6—8 inches long (Rumpf says that in Amboyna it may be a foot long), and the short podded in 4—5 inches long. Short podded specimens have been seen by me from Prome, in the Pegu bazaar and near the Sittang river at Minywa.

Cultivation.

CULTIVATION.

In the Shán States the seeds are planted in the beginning of June or when the rains begin, three inches deep in village gardens. Rich

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS.

wet soil is chosen, or if the soil is not very rich plentiful watering is resorted to. In some of the Southern Shán States such as Kentung, one finds two or three plants in the corner of a garden here and there. But in parts of the Northern Shán States the plants are much more plentifully sown. There they are to be seen in Taung-yas or forest clearings, generally where bonfires have been made round the dying trunk of a tree too large to have been cut out, *i.e.*, where the burning of rubbish, branch-wood, etc., has manured the soil. If the plant be sown in a garden, ridging is often resorted to.

Shan States.

The seedling is left to take care of itself as soon as established, having been provided with something up which to climb. It grows to 10 - 12 feet high. Sometimes the Sháns dig the root up and eat it, but more generally they leave it to produce beans which are gathered young except those intended to set seed. The crop is gathered in December and January. The tuber is said to be much larger than is produced in Burma.

The cultivator saves his own seed, but in the Hsum-hsai Sub-State, which is west of Hsipaw, the Sháns produce seed for sale to Burma; and so also is done in the near parts of the Maymyo sub-division of the Mandalay district. This seed produced is carried down to the plains and grown in the Central parts of Burma, and it sells in Kyaukse at R7-8 and sometimes R10 (10*s.* and 13*s.* 4*d.*) per basket ($1\frac{1}{8}$ bushel) or double the price of local seed. Through the Director of Land Records and Agriculture, Burma, I have received the following interesting information got together by Mg. Shwe Zan Aung, Superintendent of Land Records, Kyaukse :—

Kyaukse.

Causes of variation.

"While much of the quality depends upon the care bestowed on the selection of seeds the difference between plants grown from Shán seed and locally saved seed may still further be ascribed to the fact that in spite of the more abundant rainfall in the Shán States the hilly country is not exactly waterlogged as the plains are; for it will be noticed later on that the excess of moisture in the ground materially affects the yield.

"This is the reason why the fields slightly higher than the rest in a holding have been selected with better results than the low grounds.

Soils.

"Goa-beans thrive very well on clayey soils or non-myenu, but the tubers are too big to be prized by the people. Sandy loam or sane-mye is said to be best suited for the cultivation. The crop has also been known to grow on clayey loam or phutchai-mye.

Ploughing.

"About the months of May or June (*i.e.*, Kason or Nayon) water is let onto the selected fields from the irrigation channels and the land is lengthwise, crosswise and diagonally ploughed.

Harrowing and hoeing.

"In July or August (Waso or Wagaung) as the case may be, the land is harrowed and hoed into furrows, between which ridges or "baungs" 2 feet broad and 1 foot high are prepared with a spade, $1\frac{1}{2}$ feet apart in order not only to admit air and water freely and to drain off water effectively.

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS.

"Then the seeds are buried in small holes, about 3 by 6 inches apart, specially prepared for the purpose on the ridges.

Sowing.

"Two baskets of seeds go to an acre. If the local seeds popularly styled "Pegale" (little bean) in contradistinction to "Pegyi" (large bean) the parent seed, be used, the operations are generally a month later.

Irrigation.

"Immediately after sowing, the field is flooded from the Irrigation channels, but the water is withdrawn at once.

"The land is again subjected to alternate flood and drainage until the harvest. It is done at least three times every two months or according to the amount of the rain-fall.

"Great care should be taken not to allow the water to remain long on the fields except when the plants have flowered or fruited, for as stated elsewhere, the excess of moisture tends to reduce the number of tubers.

Weeding.

"Weeds are periodically removed—say twice or thrice during the season as the case requires—chiefly by women who are paid at 2 annas each with free meals provided by the cultivator for the day. The superfluous growth among the creepers has to be plucked out by hand. Thus the work of weeding is a tedious process and is expensive. Stakes are not used, the plants are left to lie along the ground. From January to March, *i.e.*, (Pyatho to Tabaung) when the land is fairly dry the tubers are dug up by men and gathered by women. Each labourer is paid either by the contract, or by daily wages when the out-turn is bad. The contract is 1 anna per 10 viss of tubers collected. The daily rate is Ro-6-0 (6*d.*) for each man and Ro-4-0 (4*d.*) for each woman.

"In either case in addition to these rates a bag or a load of tubers is appropriated by each labourer as his lawful wages. The digging operation serves a double purpose, 1st, for the harvest, 2ndly, as a preliminary loosening of the ground for the following crop, *viz.*, sugarcane in the Singaing township and early sesamum elsewhere.

Manuring.

"Farm-yard manure is known to have been used with advantage. Cart loads of cow-dung are scattered in small heaps and distributed by water at the time of ploughing.

Diseases of the crop.

"No insect pests are said to have injured the crop. But if not preceded by a crop especially paddy, *i.e.*, if grown on fallow land or virgin soil, the tubers become covered with excrescences. Although not exactly a disease, it is a failure from the popular point of view.

Average cost.

"The average cost per acre of the cultivation may be tabulated as follows :—

	R	*a.*	*p.*	
Ploughing	2	0	0	(2*s.* 8*d.*)
Harrowing	1	0	0	(1*s.* 4*d.*)
Preparing ridges	2	8	0	(3*s.* 4*d.*)
Weeding (twice)	8	12	0	(11*s.* 8*d.*)
Cost of seed	14	0	0	(18*s.* 8*d.*)
Sowing	3	0	0	(4*s.*)
Harvesting	9	6	0	(12*s.* 6*d.*)
TOTAL	40	10	0	

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS.

add to this R8 (10*s.* 8*d.*) or R7 (9*s.* 4*d.*), the Government Revenue, including the water rate as the land is state or non-state. The above is a consolidated revenue of which R1-4 (1*s.* 8*d.*) in the case of state lands and R0-14 (1*s.* 2*d.*) in that of non-state lands have been fixed as land rents. The total outlay therefore amounts to R48-10-0 or R47-10 (64*s.* 10*d.* or 63*s.* 6*d.*).

Average outturn and value.

"The average yield per acre is 1,500 viss (48 cwt. 99 lbs.) of tubers valued at R67-8 (90*s.*) at the wholesale price of R45 (60*s.*) per 1,000 viss (32 cwt. 66 lb.) and the net profit amounts to R19-4 or R18-4 (25*s.* 8*d.* or 24*s.* 4*d.*) per acre.

"As with other crops, so with this there are 'middle men' popularly called "Ywe" who sell the tubers to 'Letka' at the retail price of R65 (86*s.* 8*d.*) per 1,000 viss (32 cwt. 66 lb.).

Its relation to sugar-cane.

"The margin left to the *bonâ fide* cultivators after trouble and expenses would by itself not be encouraging, but the cultivators in Singaing township generally grow a bumper crop of sugar-cane in the year after Goa-beans. It is said that the cane crop, if preceded by Goa-beans, yields half as much again as usual.

Pods and Seed.

"If any plants are left to seed, the young pods may be picked and used as a vegetable. No use is made of the ripe seed, unless it be that now and then in the Ye-Yaman tract, some mischievous person saves it and sends it up to the Shán hills for the purpose of adulterating good Shán seed, or it is locally sown for two generations yielding a less and less valuable crop each time.

"As far as can be ascertained there is no record of its introduction into the province."

Some time after the receipt of the above report, Mr. H. B. Powell, who had succeeded Mg. Shwe Zan Aung as Superintendent of Land Records, Kyaukse, supplied information that the area under the crop had undergone a slight decrease owing to want of water for irrigation, several irrigation works being under repair—

Acreage.

1898	975 acres
1899	737 „
1900	807 „

As he anticipated the acreage rose again and was 2122 in 1901-02, though less again since.

Mr. T. C. Wilson, Settlement Commissioner and Director of Land Records and Agriculture, Burma, has kindly supplied to me the figures which may be found on p. 63.

The districts that adjoin Kyaukse are Mandalay, Sagaing, Myingyan and Meiktila.

Mandalay.

In Mandalay the cultivation is apparently of more recent origin than in Kyaukse. The method and the cost is the same as in Kyaukse. The market for local produce as well as very much produced in Kyaukse is in Mandalay, where 100 viss (365 lbs.) sell for R10 (13*s.* 4*d.*) in December and less sums down to R5 (6*s.* 8*d.*) in

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS.

January; the immature pods sell in Mandalay at about R5 (6*s.* 8*d.*) per 100 viss (365 lbs.). Seed in Mandalay sells at R5 (6*s.* 8*d.*) per basket, and a basket of seed gives at the most 700 viss (22 cwt. 91 lb.) of roots or 1,400 viss (45 cwt. 70 lb.) per acre. Pe-myit is not grown in the district of Sagaing and Myingyan.

Meiktila.

In Meiktila there is not much cultivated: what little there is, is in the Nyaungyan circle. The outturn is about 600 viss (19 cwt. 62 lb.) per acre.

Yamethin.

South of Meiktila is the district of Yamethin where a small acreage has been grown on the border of a large swamp in the vicinity of Pyinmana, since 1878.

The seed is sown 2 inches apart on ridges 8—10 inches high and 12 inches apart, at the end of June or beginning of July, and the tubers are in the market in January and February.

Cost.

The cost of cultivation for an acre is as follows:—

	R	a.	p.	
Half basket of seed at R10 (13*s.* 4*d.*) per basket.	5	0	0	(6*s.* 8*d.*)
Making ridges	9	0	0	(12*s.*)
Weeding	1	4	0	(1*s.* 8*d.*)
Digging up of tubers . . .	16	0	0	(21*s.* 4*d.*)
Yearly interest on a yoke of plough cattle	1	12	0	(2*s.* 4*d.*)
TOTAL .	33	0	0	(44*s.*)

Yield.

The yield per acre varies from 800 to 1,200 viss (26 cwt. 8 lb. to 39 cwt. 12 lb.) of tubers.

It is cultivated chiefly for its tubers. Pods or beans are not allowed to go to seed, but are plucked when tender and sold as a vegetable: the value of tender beans per acre is about R7 (9*s.* 4*d.*).

Not being cultivated for its seed, it is not trained on sticks. Plants grow to a height of one foot and are allowed to creep or overhang the raised ridges on which they are grown.

The price of the tubers is R6 (8*s.*) per 100 viss (365 lb.).

The area under Goa bean cultivation in the district is insignificant.

Prome and neighbouring districts.

In the districts of Prome, Henzada, Hanthawaddy, and Tharrawaddy we have rather a different cultivation, for here the land periodically flooded by the river Irrawaddy is used; and we have also a little garden cultivation on soils not so sandy as the river soils. The tuber grows larger in the sandy than in the clay soils, but has not such a good flavour. The seed is sown on manured ground and is given bamboos to climb up. The crop is said to be dug in Henzada in November and December. Cultivation is estimated to cost R40 (53*s.* 4*d.*) per acre and the yield to be 1,200 viss (39 cwt. 12 lb.). The tubers sell at about R12-8 (16*s.* 8*d.*) per 100 viss (365 lb.). We find cultivation very similar to this in the Thatôn

Thatôn.

district, where the banks of the Salween are used, and traders dispose of the produce in Moulmein. The seed is there sown in small furrows 8 inches wide and 2 inches deep. It seems that in Thatôn certain islands in the Salween are allowed to produce seed for the local crop. CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS.

In the north of Burma for Pe-myit we find garden cultivation and a little Taung-ya cultivation as in the Shan hills; also a very little about Katha on islands in the river Irrawaddy. Northern Burma.

In the Upper Chindwin district it is, for instance, always given sticks for support.

In Akyab it is grown a little on Taung yas or hill clearings. The same is apparently the case east of Chittagong. Arakan.

Extent of cultivation in Burma in acres.

	Mandalay.	Meiktila.	Kyauksè.	Yamethin.	Thatôn.
1897-98 . .	—	—	975	20	42
1898-99 . .	26	—	737	20	130
1899-00 . .	44	—	807	20	170
1900-01 . .	60	—	1,243	20	133
1901-02 . .	150	—	2,122	20	130
1902-03 . .	38	97	998	38	140
1903-04 . .	23	33	720	9	253
1904-05 . .	75	42	803	19	297
1905-06 . .	71	14	819	21	291

About Calcutta it is only to be found in gardens. I have grown it myself for several years sowing the seed early in the rains, and getting a crop of young beans in November and December. Bengal.

Over the rest of India it is grown in the same way; but Woodrow recommends sowing it on irrigated ground about Poona at the end of the rains in order to get a crop of young beans in the height of the hot weather when vegetables are scarce. (Woodrow, *Gardening in India*, 3rd Edn., 1899, p. 267.) Poona.

The root is eaten by Burmese between meal times as a delicacy; and there is an established standard size for it which sells according to season at 1 anna to ½ anna (1*d.* to ½*d.*). USES.

The trade in the roots is a large one, and they are sent in considerable quantities more than 200 miles by rail or river. Kyauksè supplies Bhamo on the north with large quantities through Mandalay and Pegu (almost certainly also Rangoon) on the south.

The root is eaten without cooking and is slightly sweet, firm like an apple and by no means unpleasant.

The unripe beans are mostly eaten locally and are not a large article of trade. They are inferior to French beans in flavour, but stand near them. I have myself eaten them many times.

PSOPHOCARPUS TETRAGONOLOBUS.

Dried roots from Kyauksé were found to have the following constituents (Hooper in *Report of the Indian Museum, Industrial Sections* for 1901-02, page 30) :—

Analysis of root.

Water	9·05
Oil	·98
Albuminoids	24·62
Carbohydrates (Starch and some sugar)	56·07
Fibre	5·38
Ash	3·90
TOTAL	100·00

The seed, not eaten in India, has the following composition (Hooper in *Report of the Indian Museum, Industrial Section* for 1902-03, page 26) :—

Analysis of seed.

Water	9·50
Oil	15·46
Albuminoids	37·43
Carbohydrates	28·38
Fibre	4·98
Ash	4·25
TOTAL	100·00
Containing Phosphoric acid	1·35
„ Nitrogen „	5·99

They are however eaten in Java, roasted in an iron pot until the shell cracks off.

In Kentung the root is said to be used as material for making a poultice for the head and neck in cases of vertigo.

PESTS.

Two fungus pests have been found on it in Java; the one Woroninella Psophocarpi described by Raciborski in Zeitschrift für Krankheiten, 1898, p. 98, the other an Uromyces described by Sydow in 1903.

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1906—No. 5.

COCHLOSPERMUM GOSSYPIUM.

(SEEDS & OIL.)

[*Dictionary of Economic Products, Vol. II.*, C. 1512-1519.]

A short Account of the seeds and oil of **Cochlospermum Gossypium**, *by* BABU SURENDRA NATH DEY, B.A., *Assistant in the Chemical Laboratory of the Indian Museum, Industrial Section.*

COCHLOSPERMUM GOSSYPIUM.

There are several trees in India which have again and again been suggested as sources of silk-cotton or 'kapok' cotton, now exported from Java in considerable quantities chiefly for upholstery purposes. In Java the tree yielding this material is **Eriodendron anfractuosum**,—a tree which is planted more for ornament than for use in Burma and on the West coast of India, but in India has never been exploited as a source of 'kapok' cotton. On the other hand, considerable effort has at various times been employed to introduce two other similar 'kapoks' to the trade, one obtained from **Bombax malabaricum**, a common tree throughout the country, and the other from **Cochlospermum Gossypium**, which occurs commonly in the drier parts of North India. This tree, according to Gamble, is characteristic of the hottest, driest, stoniest slopes, and it would obviously be of great value if its productions in the shape of silk cotton or of seeds or of both could be turned to account. The Reporter on Economic Products to the Government of India has lately issued, as *Commercial Circular* No. 2 of 1905, a report made by Professor Wyndham R. Dunstan on the relative value of the flos or silk cotton produced by this tree: in the present report it is proposed merely to give an account of the seeds and the oil produced from them.

Yields Kapok.

Up to the present, even in the districts where the tree occurs, little use has been made of the seeds. They have been used for food in Celebes (*Pharmacographia Indica, p. 151*) where they are roasted before being eaten. In India, however, no record seems to

Use of the seeds as food.

COCHLOSPERMUM GOSSYPIUM.

exist of their ever having been so employed. There seems, however, no reason why in cases of necessity they should not be used in this way.

The seeds themselves are kidney shaped or cochleate with a hard shell, about $\frac{1}{4}$ to $\frac{1}{16}$ inch long, about 400 going to one ounce. They have a pleasant sweetish somewhat almond-like flavour when tasted, followed by a slight bitterness which can hardly be called objectionable. On analysis they gave the following figures :—

Analysis of seeds.

	Per cent.
Moisture	9·25
Oil	14·25
* Albuminoids	20·94
Carbohydrates	35·78
Crude Fibre	14·63
† Ash	5·15
	100·00

	Per cent.
* Containing Nitrogen	3·35
† Containing Phosphoric Acid	0·96

The seeds contained no alkaloids, and were free from tannin. Very small traces of starch were found. A non-reducing sugar of the saccharose type was present in some quantity, and a considerable quantity of dextrins. No evil effect followed the eating of a fair number of the seeds. As a further test, a quantity of the pressed oil cake was given to a calf and a goat. Neither of them ate it with relish, but both did so after a short time. This was followed by no evil result in either case.

It may be taken, therefore, that the seeds of **Cochlospermum Gossypium** form a fairly nutritious food, and in case of necessity would be quite adapted for this purpose both for animal and man.

Analysis of oil-cake.

The analysis of the cake is given below :—

	Per cent.
Moisture	9·90
* Albuminoids	21·50
Oil	8·10
Carbohydrates	39·88
Fibre	15·17
† Ash	5·45
	100·00

	Per cent.
* Containing Nitrogen	3·44
† Containing Phosphoric Acid	0·98

It will thus be seen that the oil-cake is fairly rich in nitrogen and phosphoric acid and there seems to be no reason why it should not be used either as a manure or cattle food.

Up to the present very little notice seems to have been taken of the oil yielded by the seeds regarding its nature and use. "The

COCHLOSPERMUM GOSSYPIUM.

Revd. A. Campbell of Chota Nagpur describes a bright red oil which by hot expression he extracted in abundance from the seeds. He adds, although this property of the seeds is well known to the Santals they never extract the oil. Cook in his *Oils and Oil-seeds* alludes to this circumstance, but remarks that beyond the fact of the seeds affording an oil, nothing further is known" (*Watt. Dict. Econ. Prod. C. 1516*). Mr. J. S. Gamble is content to remark in his *Manual of Indian Timbers* (edition 1902), that "the seeds give an oil which is little used." He gives no further information nor is there any information available as to the oil ever being used as an edible oil.

Nature of the oil.

The oil, which was present in our samples of seed to the extent of 14 to 15 per cent., was expressed with a screw press and filtered before examination. The filtered oil was rather thick, of brown colour, the colour getting lighter after several days' exposure to the diffused day light, ultimately assuming a yellow colour, while the oil got quite bleached in 24 hours when exposed in thin layers. But it may be mentioned here that the oil when extracted with ether was almost colourless, having a slight yellowish tinge. It had a peculiar smell and taste of its own, was a liquid at the ordinary temperature, solidifying at 1° C and having ·922 for its specific gravity at 15° C. On analysis it gave the following results :—

Acid value.	Saponification value.	Hehner value (Insoluble fatty acids.)	Iodine value.	Reichert-Meissl value.
14·24 Mgrms. KHO.	186·29 Mgrms. KHO.	95·19%	95·97%	·19 c.c. $\frac{N}{10}$ KHO.

Maumené test or the rise of temperature of 50 grammes of the oil with 10 c. c. of pure concentrated sulphuric acid was observed to be 54°·5 C. On the addition of sulphuric acid the oil turned blue-black first and black afterwards. The melting point of the fatty acids was 35°·5 C.

Not a quick drying oil.

The iodine value and the Maumené test suggested that the oil might occupy an intermediate position between a semi-drying oil and a non-drying oil, since a drying oil is characterised by its greater absorption of oxygen and iodine and by its higher rise of temperature on mixing with strong sulphuric acid than a non-drying oil.

To test its drying property, a clean glass plate was coated with it on one part, and with fresh raw linseed oil on another part, and was exposed at the temperature of the Laboratory. At the expiration of 98 hours the linseed oil got quite dry while the other only became sticky. Further, zinc pastes of the two oils were compared and similarly those

COCHLOSPERMUM GOSSYPIUM. Oil.

of lead pastes. Five grammes of oxide of zinc and 2 c.c. of the oil composed the zinc paste and 5 grammes of white lead and 1 c.c. of the oil the lead paste. A glass plate was coated with the two zinc pastes and similarly another with the two lead pastes. They were then exposed in the Laboratory. In 22 hours the zinc paste of the linseed oil dried completely and that of the other oil became very sticky. In 72 hours the latter was tacky and got very tacky in 96 hours, *i.e.*, on the 5th day and remained so till in 146 hours, *i.e.*, on the 7th day it got almost dry and continued to remain in this condition even for a month. The white lead paste of the linseed oil dried completely in 26 hours, *i.e.* on the 2nd day, whereas the lead paste of the other oil became only tacky on the 8th day and never got dry even after a month.

Its power of absorbing oxygen was also compared with that of fresh raw linseed oil by heating equal quantities of each for 6 hours daily up to the temperature of the steam oven. One hundred parts of the linseed oil thickened in the first 24 hours and increased to 102·7; the next day a skin began to form over its surface, the weight was 104·52 and remained constant until the 5th day when the oil had been converted into a firm jelly. While, on the other hand, 100 parts of **C. Gossypium** oil did not show any increase in weight even after a week when it simply thickened.

From these above facts, it was proved that the **C. Gossypium** oil was not a drying oil, possessing drying qualities to a very limited extent, as was proved by the experiment of zinc oxide paste.

Samples of this oil were shown at the late Colonial and Indian Exhibition and these are now deposited in the Kew Museum. According to Sir George Watt, this oil can be produced cheap and in large quantities; and it may be hoped that at some future time it may be utilised if not for any other technical purpose than for the manufacture of soaps.

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THE AGRICULTURAL LEDGER.

1906—No. 7.

[Reprint from the Bengal Bulletin No. 8 of 1905.]

AGAVE and FURCRAEA spp.

[*Dictionary of Economic Products, Vol. I., A. 602-638; Vol. III., F. 749.*]

NOTES on AGAVE and FURCRAEA in INDIA.
By J. R. Drummond and D. Prain.

NOTES ON AGAVE AND FURCRÆA IN INDIA

[*Dictionary of Economic Products, Vol. I, A. 602-638; Vol. III, F. 749*]

BY J. R. DRUMMOND AND D. PRAIN.

INTRODUCTORY.

WHAT is often called "Aloe-fibre" collectively is obtained in India from different plants assigned to the genera--

(1) **Sansevieria** . . *Nat. ord.* **Hæmodoraceæ**
(2) **Agave** . . . „ **Amaryllideæ**
(3) **Furcræa** . . . „ **Ditto**

Sansevieria yields "**Bowstring Hemp**" and is dealt with in *Kew Bulletin 4, April 1887*, to which nothing need be added here except that one or more *Sansevierias* appear to have meantime come into commercial use in India.

The object of this paper is to clear up so far as possible certain questions of botanical identity with regard to those forms of (2) and (3) that are domesticated in this country, and we have accordingly dealt with their history in some detail in another part of the paper. For those who may care to know our conclusions, without following all the steps that have led up to them, the first part will, we hope, be found useful, though it necessarily anticipates a good deal that is more fully discussed in the second.

PART I.—DESCRIPTIVE.

THE first part includes—

(*a*) a brief general description of the genera **Agave** and **Furcræa**, limited however as regards the former to the section *Euagave*;

(*b*) a description of those * species which are naturalized in India, or cultivated for their fibre, with a key to the species of *Euagave*;

(*c*) remarks on certain of the species known in India.

* Also of one species which is neither naturalized nor grown for fibre, viz., the "*False Sisal.*"

AGAVE.

GENERAL DESCRIPTION OF EUAGAVE AND FURCRÆA.

Place in Classification of Plants.

We have followed Bentham and Hooker in regarding **Agave** and **Furcræa** as belonging to the **Amaryllideæ**, but whether this arrangement be adopted or not, **Agave** and **Furcræa** with a few minor genera form a natural tribe which may conveniently be styled the "**Agaveæ.**" It has been proposed to include the "**Yuccas**" with this, and to elevate **Agaveæ** to the rank of a Natural Order. The objection that this would include types with the ovary "superior" as well as those with it "inferior" is not very weighty (*cf. Engelmann's Collected Works, Cambridge Mass. 1887, p. 301*).

General Description of Flowers.

Both in **Agave** and **Furcræa** the perianth is divided into six usually uniform segments; in **Furcræa** these are separated for their whole length, but in **Agave** the "germen" (containing the ovary) is continuous with a cup which surrounds the base of the style and gives rise to the stamens, usually —though not always—at the same level as the free lobes of the perianth, which vary in outline from ovate-lanceolate to narrowly ligulate. In **Furcræa** the flower is more or less bell-shaped, and the segments broadly ovate; while the stamens often have their stalks dilated and are not inserted on the cup of the perianth but upon a ring which embraces the conical pistil. Moreover the stamens in **Agave** are doubled back within the bud, springing up elastically when the bud opens. The anthers of **Agave**—which, though absolutely large, are small in proportion to the size of the plant when compared with those of **Crinum**, or **Lilium**, for example, or of some **Gramineæ**—are versatile In **Furcræa** the stalk of the stamens (filament) is stouter and shorter than in **Agave**, and the anthers, which are usually attached by their backs to the filament, do not overtop the perianth. The style in most *Euagaves* is at first shorter than the stamens, but elongates gradually until it overtops them, after which they shrivel up with the limb of the perianth-segments, but remain attached for some time to the maturing "pod" or capsule. In **A. Wightii** (*A. vivipara* of Wight) the bases of the perianth-lobes change in texture, as the ovules ripen, and remain as a beak to the capsule.*

* *Engelmann* (*l.c., p. 304*) was led to suppose that the flower in *Agave* is vespertine or nocturnal. This was due to his having studied *A. virginica Linn.* only, a peculiar type which should probably be placed in a separate genus. The

AGAVE.

General Description of Inflorescence.

The blossoms (in **Euagave**) are arranged in clusters* on the ultimate offshoots of a compound inflorescence, which consists of a series of main branches given off spirally from the main flowering stem or scape, which attains (*e.g.*, in **A. Vera-Cruz,** *Miller*) a height of thirty-five feet including the panicle. The scape is furnished with scarious bracts, and there are similar but smaller bracts at the origin of the subsidiary branches. The blossoms in **Furcræa** are arranged in rows (with a bract to each blossom) along the secondary branches of the panicle. The arrangement of the main and ultimate branches varies considerably, but is constant and often characteristic for particular species. In all, however, it conforms more or less closely to the well known "candelabrum" structure.

The leaves of *Euagaves* are very fleshy, usually ensiform, with a thick base which clasps the trunk by a dilated margin: above this the leaf is more or less narrowed or constricted, and then broadens upwards to the middle or above it, when it tapers to the point which merges in a cartilaginous prolongation of the leaf-margins or is capped by a stiff sharp horny spine which appears to originate in twisted strands of the internal fibres. In **Furcræa** there is seldom even a vestige of a terminal spine, and the tip, though usually involute for about an inch or less, is not ordinarily cartilaginous.

of Leaves.

The margins of the leaf are beset at varying intervals with spines or prickles, differing in structure in the different species, but usually consisting of a thin sharp more or less transparent thorn arising from a broader opaque cushion which is formed presumably from the thickened epidermis of the leaf-margin. The substance of the leaf is always more or less fleshy, consisting of large loosely-compacted cellular tissue traversed lengthwise by a series of vascular bundles which constitutes the "fibre." The structure of these bundles and their direction vary with the species, but in all they appear to arch or interlace

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Indian *Euagaves* are more or less proterandrous as a rule, but are neither fragrant nor nocturnal.

* In certain species the primary division of the scape is trichotomous: that is, there are two side shoots with a third continuing the axis in the middle, but the blossoms are in pairs with a third flower at a slightly different level making up a ternary fascicle; in these fascicles the axis is presumably shortened, and the lateral bud is perhaps enalogous to a trunk-offset.

AGAVE.

General Description of Leaves.

to some extent towards the margins. The cellular tissue is replete, in most species, with mucilage* and different salts; it takes up and stores water in great quantity, and gives out under certain conditions a sweet sap or mead (as in the case of the "Pulque"-producing species). A nectar is secreted also by the flowers of most of the *Euagaves*.

The skin of the leaves is so arranged as to check transpiration (*Miss. Bot. Gard. Rep. VII, p. 52*). True hairs are altogether absent. Certain **Furcræas** have the cuticle of the under surface of the leaf equipped with minute tubercles, making the surface to the touch like sandpaper.

The leaves are arranged on the trunk or "*caudex*" in a more or less regular spiral; when the spiral is dense, a marked "*rosette*" is formed (as in "****A. vivipara**"); in other species again, such as **A. sisalana,** the leaves have the appearance of being tufted.† The angle formed by the leaf with the main axis varies greatly as between species; in the same species it is almost mathematically constant.

Frequency of Flowers.

All **Agaves** were formerly supposed to require long periods before attaining maturity, and to perish after flowering; but experience has shewn that several species are truly *polycarpic*. As a rule, however, the *Euagaves* are *monocarpic*. (Cf. *Watson in Gard. Chron. 1. 1897 pp. 166–167.*)

Not always once in the plant's life.

A. americana *Linn.* is the most variable as regards the period of flowering, but the recorded instances of prolonged dormancy are due probably to the specimens being cultivated in the north of Europe.

A. Vera-Cruz *Miller* appears to "pole" in South Spain after six years on an average, or on the Adriatic after twelve or fourteen, in a naturalized condition. In North India most of the **Agaves** (except **A. americana,** *Linn.*) seem to pole from their fifth to their seventh year, but if that be passed without flowering then not till the twelfth or fourteenth.

The Yucatan Indians are said to have a secret by which they can tell when the "**Sacqui**" (a species near to "**sisalana**") is about to pole, and by cutting off the bud poling is retarded in the interests of the planter.

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* *Saponin* is said by several writers to be present in the leaves and roots, but recent chemical analysis is reported not to have confirmed this.

† Forming a "*coma.*" ** *i.e.* our **A. Wightii.**

When a shoot has blossomed then in ordinary course it dies, but the trunk may give off living offsets, or new buds may form. In certain species, notably in **A. Vera-Cruz** and **A. sisalana**, the suckers often flower along with the parent. AGAVE. Formation of Suckers.

Poling is accelerated, and may be produced, by injury, by sharp cold, transplantation, or any other sudden change in the condition of the individual. At Algiers in 1830 the French had occasion to clear for military purposes a piece of ground that was much overgrown with **Agave** and the soldiers were encouraged to destroy the plants, which during 1830-31 they did by hacking the leaves and slicing off the cone of inner leaves by way of sabre-practice. In 1832 the whole plain was covered with the bloom of some 1,500 Agaves (*Bull. Soc. Bot. de France IX, p. 146*). The effect of checks to the vegetative system in developing floration are familiar (an every-day example is afforded by the pruning back of roses); but for most purposes it may be assumed that any of the Indian **Agaveæ** (including "**sisalana**") may flower by its seventh year or even earlier.

The flowers of all the *Euagaves* are partly "herbaceous," *i.e.*, they retain to some extent the special texture and colouring of the vegetative parts, as distinguished from those of a normal perianth. Those parts of the flower (except the pollen) that do not thus lean to the vegetative type are generally of a more or less transparent amber. In **A. sisalana**, and perhaps in other species, the filaments are delicately banded ("fasciated") with a faint pink. The ripe pollen is invariably orange yellow, though the intensity varies with the species, and in the same species with the stage of development. There seems little reason to doubt that **Euagave** and **Furcræa** are wholly anemophilous. *Miss Mulford (Missouri Bot. Gdn. Rep. VII above quoted)* evidently thinks that the high scape and honeyed blossoms serve to attract small birds and large insects Doubtless they do, and the aid given by this means is through the shaking of the flower or branches. Hybridization under artificial conditions is reported. With the larger species in a state of nature we should think it is of very rare occurrence. Colour of Flower. Wind-fertilised.

All or nearly all the **Euagaves** are proliferous, *i.e.*, instead of all the flowers producing ripe seed-bearing capsules a certain number develop buds direct without seeding, which Production of Bulbils.

AGAVE.

Bulbils.

are detachable and, on reaching the ground, commence an independent cycle of existence. Once the vegetative cone has formed in a bulbil, it is independent of the parent, as has been observed in several instances where the old plant had been killed and the pole was decaying; an example was seen by us near Calcutta on the 10th August 1904 in the case of "*A. vivipara.*" The fruit both in **Furcræa** and **Agave** when it ripens is a three-celled rather woody capsule, with a green or black rind, packed with numerous horizontal flat seeds of a shiny black, or in some species opaque. Its shape is various, from a depressed sphere to an oblong cylinder; sometimes it is furrowed or three-cornered.

Description of Capsule.

Description of Embryo and Germination.

For the embryo of **Agave** we quote *Engelmann* (l.c., p. 305):—

"*The filiform, cylindric, or slightly compressed embryo is as long as the hard whitish semi-transparent, farinaceous and oily albumen. In germination the seed-shell is elevated above the ground on top of the largely developed foliaceous cotyledon, contrary to the behaviour of Yucca where the husk enclosing the small and soon decaying cotyledon remains buried in the ground.*"

We have not seen the embryo in **Furcræa** or any account of it.

Colour of Leaves.

We have made no reference above to the colour of the leaves of the Indian **Agaveæ,** because this can best be handled in the descriptive list which follows; but the following general remarks may be found useful:—the prevailing colour of the upper surface of the leaf-blade in **Euagave** is a deep "sap green;" the under side is commonly the same, but a shade or more lighter. In **A. decipiens,*** *Baker* the whole leaf is of a bright glossy apple green, which is unusual. In different species the ground colour of the leaf is tinged with obscure shades of grey, or dull blue; and the edges may be parti-coloured, or the leaf striped with pale 'ribbons.' Several species have a bloom, on the young leaves especially, and in **A. Vera-Cruz** this is frequently so marked and permanent, even in old plants, that the leaves are termed "glaucous." In **A. Cantala** the green is much lighter and less "sappy" than in the "**americanae**" but the tint is different from the vivid green of "**decipiens.**"

* This if not identical with **A. Ixtli**, *Karwinski* is very near it.

DESCRIPTION OF SPECIES.

KEY.

ves in section flat to concave but never channelled throughout :—

Teeth minute, close set . . . . . Species ***A*** ———

Teeth larger, more or less remote :—

Leaves in a lax rosette or tufted, never less than 3 feet in length :—

Perianth segments not constricted towards the tip :—

Leaves broadest in the middle, tapering to both extremities :—

Leaves oblong lanceolate, neck sharply constricted . . Species ***B*** (americana, Linn.)

Leaves linear oblong, neck not constricted :—

Marginal prickles pointing uniformly downwards, leaf flattish throughout . . . . . Species ***D*** (Vera-Cruz, Miller)

Marginal prickles of upper part of leaf pointing upwards leaf deeply trough-shaped in upper fourth Species ***C*** ———

Leaves hardly widened in the middle very narrow in proportion to their length :—

Leaves linear lanceolate curving outwards throughout their length, terminal spine acicular . . . . Species ***E*** (Cantala, Roxb.)

Leaves narrowly oblong, not curving, stiff, erect, terminal spine conical from a stout base . . . Species ***F*** ———

Perianth segments narrowed from about the middle to the ligulate tip :—

Leaves straight . . . . . Species ***G*** (sisalana, Perrine)

Leaves drooping from their upper third or less . . Species ***H*** ———

Leaves in a close globose rosette never exceeding 3 feet in length Species ***I*** (Wightii, nobis)

ves in section canaliculate . . . . . Species ***K*** (decipiens, Baker

AGAVE.

Agave sp. . . . . *A*

Species A. described.

Leaves linear-oblong 20–30 in a very lax rosette from a moderately thickened base, deep green with a glaucous bloom, tapering rather quickly in the upper portion, about 5 feet in length and as many inches in breadth at the widest part rather above the middle, marginal prickles minute but sharp, when young garnet-coloured, pointing both upwards and downwards, sometimes absent in the upper portions of the leaf altogether; terminal spine brown, subulate, slightly channelled.

INDO-CHINA: Burma; Tenasserim.

DISTRIB.: Unknown.

This we suppose to be the same as a plant cultivated in the Saharanpur Bot. Garden under the erroneous name of "*A. Ixtilli.*"

AGAVE AMERICANA described.

A Garden Aloe of India.

Agave americana *Linn.* . . . *B*

Leaves lanceolate, many in a lax rosette from a short stout prostrate or ascending trunk which is usually hidden by their thick bases, deep green, often variegated with white or pale yellow longitudinal stripes or borders, sometimes rather glaucous; at base spreading, then ascending, tips sometimes recurved, 4 to 6 ft. long and as much as half a foot broad above the middle; sharply constricted just above the base; margins armed with strong dark brown prickles mostly pointing downwards, leaf edge between the prickles concavely indented, terminal spine slightly grooved dull brown 1 to 2 in. long derived from the upper leaf margins which for about three inches from the top are involute and horny; scape with the panicle 15 to 25 ft. in height, primary branches of the inflorescence almost horizontal, fascicles of blossoms crowded at the ends of subsidiary ascending branches; germen faintly sulcate about equalling the perianth or shorter than it, perianth lobes ovate lanceolate tips obtuse, amber-coloured as are also the filaments, pollen orange yellow, style faintly three-lobed capitate; capsule bluntly trigonous or oblong-cylindrical, rather broader upwards.

Linn. Sp. Pl. (Ed. 1) i. 323; Kunth, Enum. V. 819; Thornton, New Illustr. aft. p. 100 (also col. fig. in Select Plants); Andr. Bot. Rep. vii. t. 433 (sphalmate 438);

Bot. Mag. t. 3654; Nees, Gen. Fl. Germ. Monocot. Vol. iii tab. sec.; *Reichenb. Fl. Germ. ix. t. 374.* AGAVE AMERICANA described.

INDIA: Large gardens and parks throughout India.

DISTRIB. Gardens throughout Northern Europe and North America. Native country unknown.

The plant, widely naturalized and commonly termed *Agave americana* in Southern Europe, we believe to be **A. Vera-Cruz** *Miller.* The remarks under *A. americana* in *Linnaeus' Species Plantarum* cover both the true **A. americana** and *Miller's* **A. Vera-Cruz.**

A. Milleri, *Mart. Flor. Bras. iii.* 1. 183 appears to be this species. *A. americana, Mart. vix Linn.*, appears as regards description and synonymy to refer for the most part to **A. Vera-Cruz** *Miller.* The description of *A. americana* by *Mr. Baker* in *Gardener's Chronicle* N. S. vii. 201 (1877) gives an excellent account of **A. americana** *Linn.* but the remarks apply in part to **A. Vera-Cruz** *Miller.* The Peruvian plant named *A. americana* by *Ruiz* and *Pavon* is perhaps different from either.

Agave sp. . . . . C AGAVE. Species C. described.

Leaves oblong-linear many from a very thick short caudex which is hidden by their greatly thickened bases, dark-green, glaucous, spreading from the stem but presently ascending, tips recurved stiffly, blade six feet long and upwards, measuring eight to twelve inches at the widest part some way above the middle, and there forming a deep trough through bending of the leaf and rolling inwards of the margins, prickles very stout and black, those above the trough-like portion of the leaf spreading or ascending, the rest pointing downwards, terminal spine about $\frac{3}{4}$ in. long dark coloured. [Inflorescenec not available.]

INDIA: cultivated in the Botanic Garden, Saharanpur, received from Europe.

DISTRICT. Native country unknown.

This seems closely allied to **Agave Vera-Cruz** *Miller.* It is known at Saharanpur as *A. Jacquiniana*, but it certainly is not the plant figured under that name in *Bot. Mag.* t. 5097. The leaves of this species when fresh cut smell like cut Rhubarb stalks, and their juice soon ferments.

AGAVE VERA-CRUZ described.

The Common Grey Aloe of India.

Agave Vera-Cruz . . . . *D*

Leaves linear-oblong, many, from a short stout trunk which is hidden by their thickened bases, sage green often very glaucous, early curving upwards, the ends usually more or less recurved or drooping, four to six feet long, often rather concave at the widest part which is above the middle and attains a breadth of ten inches and upwards, neck hardly constricted, leaf margins little indented or nearly straight between the prickles, which are broad stout, black or dark-coloured, spreading or decurved, interval between the prickles about half an inch or less, seldom ¾ in.; terminal spine shortly channelled, ½—1 in. long, dark brown, not or very shortly decurrent; inflorescence panicled, trichotomous as regards the main branches which are curved and flattened, blossoms in pairs with a subsidiary bud laterally developed at a different level; germen smooth cylindric longer than the perianth, perianth-lobes linear-lanceolate of a pale amber tint, cup herbaceous, stamens much exserted, anthers half an inch in length and upwards, pollen dull-yellow, style very faintly lobed, capsule rather turgid oblong-cylindrical, tip rounded, seeds black shining. *Miller, Gard. Dict. ed. 8. n. 7.*

Agave lurida, *Zuccarini in Nov. Act. Leop. Carol. xvi. 2. 670, tt. 49, 50*; *Mart. Flor. Bras. iii. I, 185*; *Bak. in Gard. Chron. N. S. viii. 264 (1877)* excl. var. *Jacquiniana* and ref.; not of *Jacquin Coll. iv. 94, t. I*; nor of *Gawler Bot. Mag. 1522.* Agave Vera Crucis *Haw. Syn. Succ. 72.*

INDO-CHINA: Burma; Taungtha, *Burkill* 23,777! and other localities in dry Central Burma, *Burkill*: Assam; Cachar, *Burkill* 16260! Brahmaputra Valley, frequent, *Burkill* 19958!

INDIA: Bengal, Katihar, *Burkill* 20871! Gangetic delta, frequent; Botanic Garden, Shibpur, cultivated; Upper Gangetic Plain; from Tirhoot (in hedges) to Rohtak (S. E. Panjab), *Burkill* 18173, but usually planted; cultivated in Botanic Gardens as far as Lahore. Chota Nagpur; Singhbhum, *Burkill* 19759! Central India; Bilaspur: Western India; Bombay, cultivated *Burkill* 16682! 16686! Deccan; Miraj, *Burkill* 16712! South India: Bellary, *Burkill*; Chingleput, *Barber* 2401! Gantur, *Barber* 2042, 2085, Chingleput, *Barber* 2086, Kurnool, *Barber* 2041, 2068, Salem, *Barber* 2070, Kistna, *Barber* 2501, Coimbatore, *Barber*, 2502, Madura *Barber*, 2503, 2505, Anantapur *Barber* 2513, S. Arcot, *Barber* 2516, Cuddapah, *Barber* 2517, Nellore, *Barber* 2518, Tanjore, *Barber* 2529, N. Arcot, *Barber* 2531, Bellary, *Barber* 2003, 2532, Godaveri, *Barber* 2533, Tinnevelly, *Barber* 2587, 2591 Vizagapatam, *Barber* 2594; Circars: Parlakemedi, *Burkill* 24420! Ganjam; in hedges at Chatrapur. Madras Agri-Horticultural Society's Garden cultivated: naturalized in Mysore, *Butler*!

The references in *Aiton Hortus Kewensis* ii. 302 *Willdenow Species Plantarum ii. 193* and *Gawler Bot. Mag.* t. 1522 are

AGAVE VERA-CRUZ.

Confused literature.

so confused that the only safe course is to drop all three. The plant dealt with by *Aiton*, though the point is now uncertain, the plant itself having disappeared, may possibly have been the **A. Vera-Cruz** of *Miller*. The *A lurida* of *Gawler* figured in the Botanical Magazine is not **A. Vera-Cruz**, nor is it any **Agave** known to us at present. *A. lurida* Jacquin, cited by *Willdenow* as the same as *Aiton's A. lurida* and as *Miller's* **A. Vera-Cruz**, is very different from the plant here accepted as *Miller's* **A. Vera-Cruz**. The difficulty in this case has been due to the acceptance by *Aiton* in *Hort. Kew. ed. 2*, of *Willdenow's A. lurida var. a.* which is based on **A. Vera-Cruz** *Miller*, but also includes A. lurida of *Jacquin*, as equivalent to his original *A. lurida*. That original *A. lurida* may have been *Miller's* **A. Vera-Cruz** or it may have been *Jacquin's* A. lurida, it cannot possibly have been both.

DISTRIB. Native country doubtful, probably Mexico; naturalized throughout Southern Europe south of the Alps and Pyrenees, in Southern France and most Mediterranean Islands, also in North-Western Africa and Atlantic Islands; (not recorded from South-Eastern Europe or the Orient): S. Africa; Mauritius; Ceylon.

Agave Cantala *Roxb.* . . . *E*

AGAVE CANTALA described.

A frequent Aloe of parts of India.

Leaves linear—lanceolate in a lax but even tuft from a short ascending rootstock, pale green sometimes glaucous, older darker tinted, very narrow in proportion to their length which attains 4 feet and more, the greatest width just above the middle being about 3 in., usually 2¼ in., curving gradually outwards from their moderately thick bases, or in weak examples bent over almost from their origin, upper surface more or less concave, sometimes trough-shaped in the lower portion, marginal prickles large for the leaf conspicuous falcate always ascending ¼ of an inch or more in length, very sharp, pale brown or garnet coloured from a small light coloured cushion; terminal spine usually acicular, cylindrical, reddish or dark brown, half an inch to an inch in length; scape with panicle 12—18 feet in height, inflorescence borne on flexuous rather slender branches, fascicles 1-2 flowered; germen equalling or shorter than the perianth, perianth-lobes bluntly linear-lanceolate 1½ in. long, large in proportion to the germen, cup hardly any, lobes divided nearly to their bases, linear oblong obtuse, greenish yellow. [Capsule not available.] *Roxb. Hort. Beng. 25* A. Cantula *Flor. Ind. ii. 168, Ed. Clarke 296*; *Grah. Cat.*

AGAVE CANTALA described.

Bomb. Pl. 272 ;? of Galeotti; not of *Dalz. and Gibs.* which is *A. Wightii*, nor of *Prain*, which is *A. Vera Cruz*; Aloe sp. (*sub Sempervivum majus*) *Rumph. Herb. Amboin.* V. *t. 94.* Fourcroya Cantala, *Voigt Hort. Suburb. Calcutt.;* Agave vivipara, *Dalz. and Gibs. Bomb. Fl.; Bak. in Gard. Chron. N. S. viii.* (*1877*) 780; not of *Linnaeus* nor of others.

INDO-CHINA: Burma; Tenasserim, Moulmein, *Burkill* 23949.

INDIA: Tirhut; Chilwara, *Campbell*, Tarkaulia, *Burkill* and *Prain* 18918, 18921, 18928!! Upper Gangetic Plain; Etawah, Saharanpur!! Dehra Dun, *Basu*! Panjab Siwaliks; Patankot, *Burkill* 15005. Western India; Thana Bassein, *Burkill* 16656, Salsette, *Burkill* 16684, Coorla, *Burkill* 16701; Deccan, Majuri, *Burkill* 21845! Poona, Satara Road, Kolhapur, Belgaum, *Burkill*; S. India, Circars, *Burkill*; Rajamandri, *Burkill*, 17829, Parlakimedi, *Burkill* 20421! Vizagapatam, Ganjam and Anantapur Dist. *Barber* 2514! Godaveri, *Barber* 2541, 2568! S. Canara, *Barber* 2540, 2600! Chicacole, *Barber* 2088! C. India, Dongagarh and Narsingpur! *Burkill*, very common about Hyderabad, *Burkill*, 25026!

DISTRIB.—Bangka, *Lindgreen*, fide *Kurz*; Amboyna *Rumphius*; Philippines! Native country unknown.

A. Rumphii Hassk., ex descriptione, is not **A. Cantala** Roxb.: *A. laxa* Zuccarini [Bak. Gard. Chron. N. S. VIII (1877) 788 fig. 151] seems near the more flaccid form of **A. Cantala**. *A. angustifolia* Haworth, from St. Helena, is also possibly the same. *Mr. Burkill* notes that the freshly cut leaves of this species smell like Rhubarb. The "*A. americana*" from which fibre is said to be got in China (*Tropenpflanzer* V. 128) may be this species. Specimens of *A. Cantala* are often marked in collections and herbaria '*A vivipara*'.

AGAVE.

Agave sp. . . . . *F*

Species F described.

Leaves narrowly oblong, ten to twenty, tufted on a very short rather narrow caudex, never forming a rosette, making a sharp angle with the main axis, stiff and erect, sometimes pale or bluish, usually a dull green, 4-5 ft. long, breadth almost uniform from the gradually narrowed lower portion to the rather suddenly acuminate tip, small in proportion to the length, at the widest point above the middle from 3½ to 4½ in., marginal prickles rather distant weak and not prominent, chestnut or garnet coloured, their hooks sharp ascending, terminal spine stout conical ½ in. and more long, brown, slightly channelled; scape reaching 15—20 ft. with the panicle, branches of the inflorescence more or less zigzag or flexuous; germen an inch long spindle-shaped constricted just below the perianth

AGAVE Species F described.

which has hardly any cup, the lobes being deeply divided, equal to or longer than the germen, bluntly linear lanceolate thin and faintly striate. [Capsule not available.]

INDIA; Dehra Dun. *J. S. Gamble No.* 23247. Upper Gangetic Plain; Etawah, *Burkill* 18134!

DISTRIB. Native country unknown. Planted along Railways in N. W. somewhat extensively.

This species differs from **A. Cantala** Roxb. in the stiff upright leaves which are never involute and hardly concave, do not bend outwards and are seldom recurved even at the tip. It also differs as regards the flower which is smaller than that of **A. Cantala** and is more delicate in texture. It appears to be the Agave described by *Mr. T. Moore* in *Gard. Chronicle No. 37 of 1849 pp. 583 and 615* as being inflower in the Chelsea Garden in that year, which he referred doubtfully to the *A. mexicana* of Haworth. *Mr. Gamble* called his plant "*A. mexicana*," referring possibly to the species described by *Moore* which is seemingly distinct from the *A. mexicana* of *Baker* whose "var. *cyanophylla*" (*Gard. Chron. 1877 viii., fig. 36 p. 201*) may be the species of *Miller's Figures* (*vol. II. p. 148 Pl. ccxxii*).

AGAVE SISALANA. True Sisal.

Agave sisalana *Perrine* . . *G*

Leaves 20—35, oblong-lanceolate, never forming a rosette but closely tufted on the rhizome or on a very short ascending caudex which is completely hidden by their moderately thick bases, the inner making a very sharp angle with the axis, the outer gradually receding but still making less than a right angle, neck not at all constricted, colour deep green, sometimes glaucous, up to six feet long, breadth at the widest part which is just above the middle reaching ten inches, margin with or without prickles, which, if present, are weak, scattered and pale-coloured, terminal spine not channelled, glossy, purple or dark brown; scape 15 feet or more with the panicle, fascicles of blossoms rather crowded, germen equal to or shorter than the perianth slightly broadened upwards, base of perianth convex and somewhat dilated, limb suddenly contracted narrowly ligulate tip slightly hooded, style long very faintly lobed early protruded. [Capsule not available.]

INDIA: Introduced into various parts of the country between 1885 and 1892, Cultivated in Burma, Cachar, and Sylhet, Assam, Bengal, North-West India as far as Lahore, Central India, Bombay, Deccan (Poona), Mysore, Madras.

DISTRIB. Native country unknown*; introduced from cultivation in Yucatan in 1834 to islands (Keys) off the peninsula of Florida and there naturalized. Introduced into the West India Islands partly from Florida partly from the American continent. Supposed by *Schott* and *Engelmann* to be derived from a wild species but further evidence as to Yucatan species is wanted; there appear to be several in cultivation there. Cultivated in Australia, Fiji, Hawaii and German East Africa.

In India this species varies as regards presence or absence of spines on the leaf margins. We have seen (*a*) spines fully developed, (*b*) spines partially and irregularly developed, and (*c*) spines altogether absent on leaves of the same individual plant.

AGAVÈ.

Agave sp. . . . . *H*

Species H. described.

Leaves 20—35, oblong-lanceolate, not forming a rosette, the inner ascending at rather a sharp angle with the axis from a stout caudex, which is altogether hidden by their much dilated bases which attain a thickness of four inches and over,† the ends recurved for about a fourth of the total length and drooping, dull dark green, very often glaucous, reaching seven feet in length and ten inches in breadth at the widest part, which is above the middle, marginal prickles distant (at intervals of $1\frac{1}{4}$ to 2 in.) stout falcate yellow-brown from a broad pale cushion which is inserted in the leaf edge, its pellicle being easily separable from the leaf cuticle and leaving a regularly defined lunate scar on detachment of the thorn,—terminal spine not decurrent rather short but stout slightly recurved; scape attaining 20 feet with the panicle, which consists of rather slender wavy main branches spirally inserted one above the other at about a foot's interval on the main stem, fascicles of blossoms somewhat crowded at the ends of the main branches but not thyrsoidly congested, perianth about equal to the germen which is rather sharply constricted just below

* In "*Travels, etc.*" (Philadelphia 1791, London 1794) by the younger **Bartram** there is an account (p. xix of Introduction) of a *Euagave* which the author calls '*A. Vivipara*,'—but evidently solely because it was producing bulbils abundantly,—which he found on a sandy strip of the Florida coast near the mouth of the "*South Mosqueto*" River.

For reasons which need not be detailed here it seems not unlikely that this was **A. sisalana** Perrine, and had been introduced (from the W. India Islands probably) by Spanish colonists, or even previously (*cf.* p. 225 of the same work) by the natives.

† In most **Euagaves** and **Furcræas** the outer leaves droop and wither with age and also when the plant is flowering; characters taken from the leaves apply to leaves in their prime which are usually in the middle of the series.

AGAVE.

Species H. described.

the perianth, lobes of perianth dilated, almost saccate below, blade suddenly narrowed ligulate diminishing to the obtuse tip which is subspathulate, capsule about 2 in. long narrowly turbinate strongly sulcate at the top especially.

INDO-CHINA: Burma; Southern Shan States, Lwekaw and Saga, *Abdul Khalil!*

INDIA: Bengal, planted in a hedge at Barrackpur!! Upper Gangetic Plain; Saharanpur and elsewhere, planted and naturalized in hedges!! Dehra Dun; naturalized and in hedges! Cultivated at Lucknow, where received from Central India, also at Lahore. Madras; N. Arcot, *Burkill* 15145! Chingleput 2087, *Barber!*

DISTRIB. Nat. country unknown.

This is the finest of the naturalized Indian species and might, by the description, be near an **Agave** from Jamaica *(Sir D. Morris)* described by *Mr. Baker* as *A. Morrisii* in *Gard. Chron. Ser. iii. I, part 1, (1887) p. 549, fig. 105,* but we think that the Indian plant is very closely allied to *A. sisalana.* The freshly cut leaves smell like stalks of Rhubarb.

AGAVE WIGHTII described.

The small Aloe of India.

Agave Wightii *nobis** . . . *J*

Leaves ensiform linear-lanceolate, very many, inserted in a compact series on a stout usually conspicuous trunk which is partly procumbent, or throughout ascending, forming a stiff even rosette 3 to 5 feet in diameter, pale green often tinged with ashy grey, base thin broadly amplexicaul, length attaining 3 feet, but not more than $2\frac{1}{4}$ in. on an average, breadth at the middle where the leaf is widest $3\frac{1}{2}$ in. or less, flat or very slightly convex; marginal prickles rather weak about $\frac{3}{4}$ in. apart, sometimes spreading or erect, but usually consisting of a small brown cushion carrying a semi-transparent garnet-coloured spine which is often sharply recurved parallel to the leaf edge, but ends in a finely-barbed hook which invariably points upwards, terminal spine about half an inch long, pale, slightly

* **A. Wightii** *nobis.*—Caudice amplo manifesto, foliis 2—3-pedalibus medio circa tres uncias latis basi parum incrassata late dilatata summum caudicem amplectentibus lineari-lanceolatis griseo-viridibus, foliorum margine spinis uncinatis primum refractis apice demum ascendente munito, scapo ad 15 pedes altitudinis assurgente paniculam oblongam sustinente, perigonii lobis superne in unguem subito angustatis vix uncialibus obtusatis unguibus denique herbaceis incrassatis cum capsula ovato-turbinata pro rostro persistentibus, seminibus opacis.

AGAVE WIGHTII described.

decurrent; scape twelve to fifteen feet high with the panicle, which is oblong-pyramidal, the main branches short trichotomous, fascicles rather crowded, germen nearly spindle-shaped rather shorter than the perianth and constricted below it, cup of perinath soon dividing into six lanceolate segments each ending in a narrowly ovate lanceolate limb, which is slightly thickened at the obtuse tip and (in dried specimens) obscurely hooded, greenish yellow; capsule brown very broadly turbinate $1\frac{1}{4}$—$1\frac{1}{2}$ in. long rostrate by the indurated bases of the perianth lobes, seeds opaque dull charcoal-coloured.

Agave vivipara.—*Wight Ic. 2024*; *Bak. Gard. Chron. N. S. viii. (1877) 780 excl. all syn. except Wight*, not of *Linnaeus*, nor of *Hill (Veg. Syst. xxiii. f. 56 fig. sinistr.)* nor of *Miller* nor of *Aiton*, nor of *Dalz. and Gibs. Bomb. Flor.* Agave Cantula, *Dalz. and Gibs. Bomb. Flor.* not of *Roxb.*

INDO-CHINA: Sylhet, Moulvi Bazar, planted near villages, but not plentiful, *Wyper*.

INDIA: Bengal; Burdwan, *Burkill* 18930! Hughli-Howrah, in hedges; cult. in Botanic Garden, Calcutta. Tirhut; Tarkaulia, *Burkill and Prain* 19923! Upper Gangetic Plain: Moradabad, *Burkill* 14954! Delhi, *Burkill* 14963, Rohtak, planted in hedges, *Burkill* 18184! commonly naturalized from Saharanpur and Ludhiana as far as Delhi, *J. R. Drummond*!! Cult. and naturalized in Hort. Saharanpur, *Duthie*! Central India; Gwalior, *Maries*! Dehra Dun, *Basu*! Deccan; Berar, *Burkill* 19179, Buldana, *Burkill* 19179! Takari, *Burkill* 16706, Sattara Road, *Burkill*; Poona, *Burkill* 25816! Western India; Bombay, *Burkill* 16677 and 16687! South India; Madras, cult. and naturalized in and near Agri-Horticultural Society's Garden; Chingleput, in hedges, *Barber* 2402! Madura, *Barber* 2504! Tanjore Dist., *Barber* 2515, 2565! Malabar Dist., *Barber* 2535!

DISTRICT.—Native country unknown. A variegated form cultivated in public gardens throughout India is very near this, if not identical.

AGAVE DECIPIENS described.

Agave decipiens *Baker* . . . . *K*

Leaves fleshy linear many closely inserted on an often erect caudex which attains 3 to 4 feet in height, forming a compact radiating tuft, of which the outer leaves are nearly at right angles with the axis, the inner making gradually an acuter angle, 2—4 ft. long, widest just below the middle where the breadth seldom exceeds $3\frac{1}{2}$ in., basal fifth of leaf bluntly trigonous, convex on the sides forming a stalk, upper portion concave often forming a deep U-shaped trough above the middle, the whole leaf stiff, glossy apple-green, more or less recurved and falcate longitudinally, marginal prickles half an

inch to 1¼ in. apart, red-brown, very small but sharp, base inconspicuous, seated on a deltoid prolongation of the light green leaf edge, terminal spine half an inch long and more, with a shallow channel, not decurrent, blackish, very sharp, inclining backwards. AGAVE DECIPIENS described.

[For the inflorescence, which we have not seen, we are indebted to *Mr. J. G. Baker (in Kew Bulletin, July-Aug. 1893, CCLVII* **False Sisal)** as follows,—

> *Peduncle* with panicle about five times as long as the leaves. *Panicle* 8—10 feet long, with a rather flexuose axis, and usually single dense clusters of flowers terminating the laxly-disposed simple arcuate branches.
>
> *Flowers* arranged in dense clusters. Ovary oblong, finally 2 in. long, ¾ in. diam. *Perianth* greenish-yellow, an inch long; tube broadly funnel-shaped; lobes complicate lanceolate from a dilated base, twice as long as the tube. *Stamens* 18—21 lines long, inserted at the middle of the perianth tube; anthers linear ½ inch long. *Styles* finally reaching to the top of the stamens.]

Cultivated only in Botanical and Horticultural Gardens at Calcutta, Saharanpur and Lahore: naturalized in Florida with **A. sisalana** Perrine; native country unknown.

From *Karwinski's* description quoted by *Kunth* (*Enum. V. 835*) *A. Ixtli* Karwinski, a native of Yucatan, should be very near this species. The plant sometimes termed *A. Ixtli* in Indian Gardens has nothing to do with *Karwinski's* plant or with **A. decipiens** *Baker.*

The best known of the fibres called "Istle" or "Ixtli" in Mexico ("Tampico fibre" of the trade) is not derived from any **Euagave** and has nothing in common with *Karwinski's* **A. Ixtli** except the name. The Istle which has been identified by *Spon* and others with *Bromelia sylvestris* or *Nidularium Caratas* is of course altogether distinct, but *Mr. Dodge* has perhaps not hit on the correct solution of the puzzle. *Mr. J. C. Harvey,* writing from the state of Vera Cruz, informs us that the Ixtli of that region is a Bromeliad which yields a good fibre. The confusion has arisen from forgetting that a vague vernacular name may cover half a dozen different species utilised in as many different areas. Ixtli fibre. Confused nomenclature.

A. Ixtli, Salm (of *Gartenflora* 1883 *p. 149 cum fig. p. 150*), is identified with "*A. Karwinskii*, Zucc. *in Kunth's Enum. V.*

AGAVE DECIPIENS.

387" and with *Engelmann's A. rigida* (387 is a slip for 837), where *A. Karwinskii* of *Zuccarini* is described from the *Nova Acta Acad. Carol. Leopold.*, the description not agreeing very well with the sketch in *Gartenflora*, which is like *A. ixtlioides* of *Bot. Mag. 5893.* "*A. rigida*" of *Engelmann*, which includes **A. sisalana** *Perrine*, is, so far as **sisalana** is concerned, a very different type of **Euagave.**

FURCRAEA. Species 1. described.

Furcræa sp. 1

Leaves 20—40 rather sharply ascending from a short fairly stout trunk forming a compact tuft, obovate-lanceolate, bright green, upper surface glossy, perfectly smooth on both surfaces, 4—6 feet long and upwards, breadth at widest part which is somewhat below the middle 8·5 in., thickness at this point ·75 in. or under, hardly constricted above the base which is 4 in. across by 2·5 in. or less in thickness, margins irregularly furnished with weak spreading prickles, pale below, rust coloured upwards, occasionally quite spineless, margins involute just below the leaf-apex forming for the last ·75 in. or less a green canaliculate blunt unarmed acumen.

[Inflorescence not available.]

INDIA: cult. in Botanic Gardens, Calcutta, Saharanpur, Lal Bagh, Bangalore (also a variegated form) and most public Gardens in India; Dehra Dun, *Hasu* (but probably from a garden)! planted by Railways in the Deccan, Miraj, *Burkill*; planted and naturalized in W. Mysore, Yercaud, and on the Shevaroy Hills, *Cameron*; near Coonoor *Butler*!

DISTRIB: The native country is not accurately known: it is understood to be extensively cultivated from Venezuela to E. Brazil, whence it was introduced by Father Leries, almoner (of his order?), to the Mauritius, in the 16th century (*Aublet* I. 305) and from the Mauritius, we suppose, to S. India, where it is known as "**Mauritius hemp.**"

The leaf* when crushed exudes a colourless fluid which has a faint but by no means fœtid odour. This plant can hardly be

* Both surfaces of the leaf in this **Furcræa** have a minutely punctulate appearance. This under the lens is found to be due to groups of stomata, in each of which the lumen is occluded by an inorganic laminated octahedral body. In **F. Selloa** (and presumably other species in which the back of the leaf has an "emery paper" feel) these occluded stomata are more numerous, and accompanied by minute cones of the same inorganic structure, ending in an edge like that of a cutting diamond, with their sides laminated, embedded in the cells of the epidermis and extruded fro a cavity which is probably a metamorphosed stoma-chamber.

For the microscopical analysis we are indebted to *Dr Irvine Fortescue*, lately Offg. Curator of the Royal Herbarium, Calcutta.

the *Furcræa gigantea* of *De Candolle* (*Plant. Succ. Hist. 126*) or the *Agave fœtida* of *Jacquin* (*Ic. Pl. Rar. F.* 379) which are apparently the same as *Plukenet's Aloe americana radice tuberosa fœtida minor non spinosa, Phytog. t. 258, fig. 2; Almag. p. 19*, because the leaves of the plant figured by these authors are described as fetid. Nor does it agree with *F. gigantea*, Baker (*Gard. Chron. N. S. xi. (1879) p. 623*) because the leaves of his plant have brown pungent points, whereas in our plant the point is green, blunt and not at all pungent. Further, the leaf of *Baker's* plant is described as much thinner in the middle, one-eighth of an inch, as against five-eighths to three-quarters of an inch in our plant. What appears to be the *Agave fœtida* of Linnaeus is in cultivation as a hedge plant in the Calcutta Garden, and is manifestly distinct from either of the species reputed to yield marketable fibre in India.

FURCRAEA. Species 1 Nomenclature. Agave Foetida.

Furcræa sp. 2

FURCRAEA Species 2. described.

Leaf sharply constricted above the base, light green, surface plaits obscure, tip cartilaginous ending in a small but distinct slightly recurved yellow brown spine about $\frac{3}{10}$ in. long; branches of flowering panicle spreading, perianth segments linear-lanceolate, obtuse, white, externally greenish with faint darker stripes within, anthers rounded, filaments about four-fifths of an inch long, dilated, at the widest about $\frac{1}{8}$ of an inch broad; otherwise, so far as the material goes, very close to the preceding.

India: Mysore; *Butler*!

By *Baker's* description this should be his *F. gigantea*, and it is evidently the same as *Wight Icones* 2025. It seems doubtful whether *F. Commelynii* Baker be the same as *F. Commelynii*. Salm Dyck, which indeed seems to be the *Agave foetida* of *Linnaeus* and the *Furcraea gigantea* of *Ventenat*. The "*Mauritius Hemp*" of South India therefore cannot be with propriety spoken of as *F. gigantea*.

REMARKS ON CERTAIN SPECIES KNOWN IN INDIA.

Indian economic writers have been constrained either to class the different "**Aloe fibres**" all under one head, or to classify them roughly under provisional names such as "*americana*,"—

AGAVE SPP. Indian species have not been fully identified.

"*vivipara*," etc. (*Royle, Fibrous Plants of India, London 1855, pp. 41-50: Watt, Dict. Economic Products, Vol I, pp. 133-44.*)

Royle was aware of it.

Royle was aware (*Ill. Himalayan Botany, p. 374*) that several species of **Agave** were naturalized in India, and he gives *Banskeora* as the vernacular name of "*A. vivipara*"; but in his Report on Indian Fibres he did not attempt to discriminate between the species from which fibre was taken for the experiments detailed in his work, the reason obviously being that no one could say what plant was used for any given experiment.—

Watt made it obvious.

Sir George (then Dr.) Watt (l. c.) writes as follows,—

* * * * *

"*At the present moment it is next to impossible to arrive at any definite knowledge regarding the species and varieties cultivated for their fibre.*"

* * * * *

"*An important step would be taken were the fibre-yielding plants to be carefully referred to their respective genera. The account of A. americana in the succeeding pages should be viewed more as Aloe fibre plant since it seems probable that the name A. americana is popularly given to a series of species and varieties yielding allied fibres.*"

The first step indeed towards developing the "**Aloe fibre**" industry in India, is to ascertain as accurately as possible what are the species of **Agaveæ** that are already naturalized or cultivated for their fibre, and it is to facilitate this that the present paper has been undertaken. When we know what is already growing in the country, and how different species thrive in particular tracts, the proper authorities will be in a position to deal with the economic history and capabilities of the different species, and to advise as to the encouragement of particular kinds in different localities, or the introduction of new sorts, just as **Agave sisalana** was brought in through the efforts of *Sir George King*, thus reviving the public interest in these products, which was weak or dormant so far as India was concerned since the work of *Roxburgh* was closed in the beginning of the last century.

Why the identification has been left so long.

Living plants of this family are not always easy to describe or identify, while their classification by means of herbarium specimens has been so far found to be impracticable. The bulk and habit of the plants,—the similarity of some

AGAVE PRODUCTS.

forms in their earlier stages,—above all the long and uncertain period of maturity which marks all the **Euagaves** and most **Furcræas** have proved serious impediments to the study even of living **Agaves** through public and private collections in Europe and America. It is hardly surprising, therefore, that the botanical information should be imperfect (*cf. Zuccarini Pl. Nov. vel Min. Cogn., Fasc. I., Ratisbon 1832, p. 42*).

Early Travellers to America made acquaintance of plants,

they found sundry products to be obtained by Haitians and Caribs from them.

As regards the history of the economic species there is much to be found in the great work of *Martius* (*Flora Brasil. Vol. III., pars I, pp. 190—197*). Following him largely, we conclude that the early European voyagers to the West India Islands found the existing occupants getting sundry products from different **Agaveæ** and **Bromeliaceæ** and that certain kinds were famous for their fibre, which was worked up into various commodities such as thread, coarse twine, nets, bags, and cordage. "Floss" or tow was got from the leaves of a kind which was known to the English adventurers as "*Silk grass.*" The dried tissue (medulla) of the flowering stem served for tinder; while a kind of paper,—or rather parchment,—was prepared from the same leaves that produced fibre for string-making. From the "floss" cloth was woven. The leaves of some species contain a detergent mucilage and both these and the roots were ordinarily used for the same purposes as soap until quite a recent period in the West Indies. (For medical uses *Martius* (*l.c.*) and other authors cited by him may be consulted.)

PRODUCTS AND VERNACULAR NAMES OF AMERICA.

Henequen.

Pita.

Martius believes that the fibre plants and their products were alike known to the Haitians comprehensively as "*Henequen,*" the corresponding term in the Carib dialects being "*Pita,*" and he suspects that the Carib Indians took at least one of the **Furcræas**,—and the name *Pita*,—to the shores of S. America.

Maguei or manguai.

From *Peter Martyr's* account of San Domingo it would seem that the word "*Maguei*" or "*Manguai*" also belonged to the native language of Haiti. Be that as it may, the Spaniards took the names *Pita* and *Maguey* with them to the mainland, and applied the latter to species of **Agave** which they found abundantly cultivated on the table-land of Mexico for the sake of the saccharine juice which the leaves distil when cut just before "poling." The plant was known to the Aztecs as *Metl* (a generic term) and the liquor as "*Octli.*" Fermented to a kind of cider (with the addition of a herb known as

Metl.

AGAVE PRODUCTS.

Ocpatli) *, it was, and is, the national beverage of Mexico—"*Pulque*" or "*Pulco*". A spirit is said to be made from the same secretion, and known as "*Aguardiente*," i.e., "Firewater."

Pulque.

Aguardiente.

Caraguata. Karato or Curaça.

Another name, in the Islands especially, was *Caraguata*, *Karato*, or *Curaça* which applied particularly, it would seem, to the **Furcræa tuberosa**.

Pati.

"*Pati*" according to *Hernandez* was the Mexican name for a *Metl* which produced the finest fibre, or tow, and was probably the mainland equivalent of "*Henequen*."

The term "*Pita*" has spread over the world and has been embodied even in the dialects of S. India.

Sources of pulque.

Recent American investigations have shown (*J. N. Rose in Contrib. U. S. National Herbarium, Vol. V. p. 223*) that there are several species of **Euagave** which yield "*Pulque*," but the principal appears to be the **A. atrovirens** of *Baron Karwinski*, which is identified by several continental botanists with *A. Salmiana* of *Otto*. From the descriptions as well as from photographic illustrations that accompany *Mr. Rose's* paper, this form must be closely allied to *A. lurida H. B. C.*, but abundantly distinct from **A. americana** of *Linnaeus*. As regards spirit yielding **Agaves**, *Mr. Rose* states that the spirit is now called "*mescal*" or "*tequila*," and he adds "*while it is uncertain from what species tequila is made, it is at any rate not A. americana.*" *Sotol*, another alcoholic preparation which the traveller *Lumholtz* derived from a plant "of the same family as *A. americana*," is produced, not from any **Agave** at all, but from a **Dasylirion**. *Hernandez* figures a "*Mexcal*" that looks like the "*Agave Gilbeyi*" of gardens; which is not an **Euagave.**

Sources of Mescal or Tequila

Sotol.

Mexcal.

Ixtli, istle or Tampico fibre.

One other native term requires mention, viz., that of *Ixtli* or "*Istle*" which is often applied to the plants that yield the product known commercially as "*Tampico fibre*" from the town of export. Recent information as to these will be found in *Mr. Rose's* "*Notes on Useful Plants of Mexico*" (*Contrib. U. S. National Herbarium, V. p. 242*) already quoted, as well as about other fibre plants of Central America, but the fact is that there is not a single fibre-yielding species of the **Agaveæ** or **Bromeliaceae**,—to say nothing of **Yucca**,—that can be said to have been as yet sufficiently identified.

* In a recent publication this i said tso be **Datura Stramonium** Linn., which is improbable; though it may be some other species of **Datura**.

AGAVE PRODUCTS.

"*Tampico*" or "*Lechegnilla*" fibre, however, is believed to be got from species that do not belong to **Furcræa** or **Euagave,** and its chief interest for Indian workers lies in the circumstance that "*Ixtli*" has been also reported as a name for certain Yucatan species of **Agave,** with this consequence (among others) that the well known "**Sisal Hemp**" (cultivated in the Bahamas and the British East Indies) appears in some botanical works as a variety of *A. Ixtli* Karwinski or of *A. Karwinskii* Salm. As the descriptive list of species will have shewn, we propose to call the true **Sisal Agave** of Florida and India **A. sisalana**, *Perrine* (ex Engelmann) or more briefly **A. sisalana,** *Perrine.*

Ixtli applied wrongly to Sisal.

True Ixtli or Tampico fibre

no —the which ndia

SPECIES IN INDIA ARE OF UNEQUAL VALUE.

The species included in our brief Descriptive List are not of course of equal economic value: **B=Agave americana** *Linn.,* is not naturalized apparently in any part of India, but is grown in gardens and about houses as an ornament, the particoloured kinds being in vogue chiefly. Small articles have been made from its fibre as curiosities, or for exhibition purposes, but this species does not seem to be grown or utilized for economic purposes in India, or indeed anywhere. When "*A. americana*" is spoken of as a "*Fibre Aloe*," some other species almost always is intended.

The true A. americana is not a fibre plant.

There is a widespread idea that there is quite a number of varieties of "*Agave americana.*" There are several variations of the leaf, *e.g.*, with white bands along the edges, or a white stripe down the middle, due to the industry of horticulturists, but,—like other **Euagaves** so far as we have seen,—the essential characters of this well known garden species are particularly constant.

The native country is unknown (*A. De Candolle, Geograph. Botanique, p. 983*), but may be in the W. India Islands.

A. Vera-cruz seems to be the so-called A. americana of S. Europe.

As regards the fibre of **Agave D.,** *i.e.*, **A. Vera-Cruz** *Miller,* (= "*A. murida*" of the *Calcutta Garden*) we have practically no information. We believe that this is the **Agave** which is naturalized on a great scale in S. Europe and N. Africa; in S. Europe it is often called "*Agave americana,*" and it was most likely the "*American Aloe*" of the earlier writers till *Linné* appropriated the specific name for the garden plant of N. Europe. In India it is established as a hedge plant in Bengal and S. India; there are specimens from the Bombay neighbourhood also, but how far it may have run wild on that side

Distribution in India.

AGAVES IN INDIA. of India remains doubtful. It occurs with other **Agaves** throughout the Gangetic Plain as far north as Cawnpore but

A. vera-cruz. usually though not always planted. Further to the north and west it seems little known and we suspect that the climate of Hindustan and the Panjab is not well suited to it. In the Royal Garden at Sibpur, where it was introduced by *Lord Auckland* when Governor-General in 1836, this **Agave** luxuriates. Its range in Europe (under the continental name of "*Agave americana*") is shewn in an account and chart in *Gartenflora* 1875 by *H. Hoffmann** (*p. 70 and t. 825 No. 1*).

Unknown origin. Sharp frosts are evidently fatal to it, unless it is artificially protected. This might be expected if it was the plant which *Schiede* and *Deppe* saw wild in the country between Vera Cruz and the table-land of Mexico (*Linnaea, IV pp. 208, 582 etc.*) but the brief description of that rather suggests **A. Wightii**.

AGAVE species C. The reasons for giving **C** a place in the Descriptive List will be found under Part II, where it is suggested that this handsome species (formerly named "*Jacquiniana*" in the Saharanpur Garden) may be *Karwinski's* **A. atrovirens** or some closely allied form.

Agave Cantala perhaps first to each India. An important point about the next species in the List (E. = **A. Cantala** *Roxb.*) is that though utterly distinct from **J** of the same = "*A. vivipara*" of *Wight*, (in place of which we recommend the name of **A. Wightii**,) it has nevertheless been very frequently confused with it, as will be explained more fully in Part II of this paper. **A. Cantala** appears to have been the first **Agave** to reach the East Indies, which it did most likely from the Pacific Coast of Central America. It is well figured in *Rumpf's Herb. Amboyn.*, and that illustration is quoted by *Roxburgh* as applying to his **A. Cantala**, which he supposed to be a native of India.

Distribution. This seems to be a common hedge plant near Bombay, in the north of Madras, and in the Gangetic Plain, and extends

* He includes certain stations of flowering in the open in Brittany and the S. W. of England which are usually given to the true *A. americana*, but it is quite possible that the plants which flowered there were *A. Vera-Cruz*. *A. americana* seems to be much hardier, as *Miller* has noted. The variegated specimen (see *Sir W. Hooker's* note in Sims) from which plate 3654 Bot. Mag. was taken flowered at Aikenhead in Scotland.

In August 1901 *A. americana* Linn. flowered in the open at Kingcausie, Maryculter, Kincardineshire in the N. E. of Scotland (*Dr. Irvine Fortescue*).

into the submontane Districts of the Agra Province and the Panjab. AGAV IN INDIA.

Fibre has undoubtedly been extracted from this species on a considerable scale, but opinions on its quality are conflicting. Agave Cantala a fibre plant.

In the Dehra Dun and in the Panjab Siwaliks still another **Euagave** occurs in a half-wild condition from which a good fibre has been got for certain purposes, and the same has been planted on a marketable scale in the dry tract between the Chambal and the Jamna. This was sent to the Calcutta Garden as *A. mexicana*, but as will be seen under Part II, *Lamarck's* "*mexicana*" is not a good species, and the rules of nomenclature debar the reapplication of the title to a different species. We have not been able to identify the species clearly with any named **Agave** of which we have the description, and it has therefore to appear in the Descriptive List anonymously as **Agave "F."**, but it is pretty certainly the same as a species which blossomed in London in 1849 and was doubtingly referred by *Moore* to the *A. mexicana* of Haworth (which is *not* that of *Lamarck*). AGAVE species F. also a fibre plant.

"**H**" is a fine **Euagave** which occurs in several parts of Bengal and the Gangetic Plain as far North as Saharanpur, where it has run wild in the Botanic Garden, and is known, but incorrectly, as "*A. lurida*." There does not seem to be any record of experiments with the fibre of this species, but the late *Mr. Gollan*, who had extracted it, informed us that it is of good quality so far as he could judge, and that the leaves are easy for the work people to handle. AGAVE species H.

It flourishes under the same conditions as **A. Wightii**, and the two, though otherwise strongly dissimilar, are often found in the same hedge, though not necessarily planted out at the same period.

This has the largest leaf of all the **Agaveæ** hitherto observed in India attaining 7 to 8 feet and over, with a corresponding breadth, though the leaf is narrower proportionately than in **A. Vera-Cruz** for example. We are disposed to refer it to the **Sisalana** group of **Euagave**. There are specimens from Madras, which we had placed under this species, but they seem poorly developed in comparison with those from N. India. The largest of all Indian Agaves in leaf.

We have not yet mentioned the first species in the List, viz. **A**, which differs from all the others by the margin of the leaf.

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It is included because the Saharanpur plant is possibly the same as a form received in the Sibpur Garden from Burma, and said to be naturalized in that country. Very little is known of this **Agave,** which is also unidentified; further remarks upon it will be found under Part II.

Agave species A.

Agave Wightii.

The last naturalized **Euagave** in the Descriptive List is a well-known form in Southern, Central, and North-Western India. In the N. W. it is looked on (as **A. Cantala** is in some parts of India) as "*desi*," or "native," but this means no more than that it spreads itself without the direct aid of man, and that there is no current tradition of its introduction. This species should be recognized easily by its round compact rosette, by the rather pale tint of the leaves, and their stiff habit. It is the only **Agave** in North India moreover that develops a conspicuous trunk, though this does not always happen.

It may develop a stem.

The division which has sometimes been adopted of **Euagave** into two groups of "*caulescent*" species and "*stemless*" seems inconvenient. The same species may under one set of conditions, or at a particular stage of its development, appear to be stemless and yet develop a conspicuous stem or "*caudex*,"—somewhat on the plan of a small **Palm** or a **Yucca,**—at a later period or under altered surroundings. The truth seems to be that all the **Euagaves** have more or less of a stem above the crown of the rhizome though it usually is concealed by the outer leaves in most of them. At the same time certain species are more apt to develop a manifest trunk than others, although no known **Agave** attains in this respect the stage arrived at by one of the **Furcraeas** (**F. longaeva** *Zuccarini*). Probably the "cauiescent" species shed their outer leaves periodically, pushing up the vegetative cone with more rapidity than the so-called stemless forms, so that the portion of the trunk which has shed the older leaves is large and conspicuous.

Wide spread in India.

At all events this is something like the process which takes place in the species figured by *Wight* as "*A. viripara*" (l. c. 2024). This well-marked **Agave** is that most widely spread in the drier parts of India, from Mysore to the Panjab, though from many intervening parts it has not been reported. It extends to the very south of India and east to Bengal and Assam, but does not thrive well in a damp climate. *Wight,* following *Buchanan* probably, referred his plant to the

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"*vivipara*" of the *Species Plantarum*, but that is an utterly ambiguous species not founded on living or Herbarium material so far as we can discover, and the proper course is to drop the name altogether. *Miller's* "*vivipara*," which may be the "*vivipara*" of some continental authors, is obscure, but it was certainly remote from the plant of *Wight* and *Buchanan* and we have proposed **Agave Wightii** accordingly.

Agave sisalana.

There remains only "**G**" of the Descriptive List, the "**true sisal**" which was introduced into Bengal some twelve years ago, as explained in *Bulletin* No. 5, 1899 of this Department **(Agave sisalana).**

Under Part II, the history of this staple in America is fully considered, and reasons stated for re-placing the present scientific name ("*A. rigida*, var. *sisalana*") by **A. sisalana** simply, as was done indeed by *Col. Prain* in the Bulletin just quoted.

About the same time that the Bengal Government was bringing "**Sisal**" into N. India, it was being introduced into the Mysore State as set out in an interesting note by *Mr. Cameron*, Superintendent of Government Gardens, Bangalore, from which an extract is subjoined as follows :—

Introduction into Mysore.

"Acting on my advice, and kindly assisted by the authorities at Kew, the late Mr. Ricketts was able, in 1892, to import 5,000 plants direct from Florida. Prior to this date a few plants of *Agave rigida* had found their way into the Botanical Gardens, but it is quite impossible that the variety *Sisalana* had ever appeared in the Province before. We may therefore take 1892 as the starting period of this important cultivation.

"The plants from Florida arrived in excellent condition and were at once planted out in the Lal Bagh. In view to hardening them off and inducing them to reproduce their kind, it was decided to plant thickly in an open field which had formerly been cropped with ragi and other dry crops. The bulk of the consignment was therefore laid down in a plot of land measuring only $\frac{1}{8}$ of an acre. With exception of occasional thinning out to relieve congestion and meet small indents, the original plants still remain in this position where they form an overcrowded and conspicuous clump. Suckers were

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SISAL. Introduction to Mysore.

allowed to grow and the matured leaves of parent plants have not been cut, hence poling commenced in the 9th year, or in 1901. Poling or the growth of the floral axis, forming flowers, fruit, seed, and adventitious buds renders propagation easy as each pole gives birth to upwards of 2,000 buds, which shortly develop into bulblets that mature and fall to the ground.

"It will thus be seen that the main object of cultivation in the Lal Bagh during the period under report has been to induce poling and render the plants hardy. We shall now have ample material to commence cultivation for another object, if desired, viz., to produce Sisal Hemp, the valuable product of the leaf. During the current official year 45,000 plants have been sold for that purpose, at a cost of Rs. 1,000; a sum which more than twice covers the original outlay for introducing the species from Florida.

"In my opinion, cultivation should be left to private enterprise, though in the case of arid tracts where ragi often fails to reward the raiyat, it may be feasible to substitute a crop of the kind. But that could only be done when a real demand for hemp arises at convenient centres. The advantages of the cultivation may be briefly stated as follows:—

1. Land of a gravelly and stony nature is suitable.
2. When land is planted up, the cultivation practically ceases for a period of 4 years, or until the matured leaves are ready for cutting.
3. On suitable land failure of crop has never been heard of.
4. The profit on an acre of land yielding crop is estimated at £4 to £5 per annum, that is 60 to 75 rupees.

"The large succulent growth obtained in rich land is inimical both to the quantity and quality of fibre produced; therefore somewhat poor land of a loose

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SISAL. Introduction to Mysore.

stony nature is always preferred, as in addition to giving better results generally it accommodates a larger number of plants to the acre. Mysore possesses plenty of such land, and if the latter can produce leaves of four feet in length it will do. But there is a reduction in value, as well as difficulty in extracting the fibre, when the leaves are under three feet in length. In Yucatan, plants are put out in rows at 7, 8, 9 and even 12 feet apart, according to the nature of the soil. But the general practice is to allow nothing under 400 plants to the acre, while 660 is considered about the maximum number. In the Bahamas the planting is somewhat closer. When a plantation is once established it may be profitably worked for a life time, care being taken not to let the plants pole or become exhausted from over-cutting. In a large plantation drives are left at convenient intervals to facilitate the easy removal of leaves."

* * * * *

Recent information on the growing of A. **sisalana** will be found in the Year Book of the United States Department of Agriculture for 1903 (*Washington 1904, pp. 395—396*).

FURCRAEA IN INDIA.

The only **Furcraea** that is grown on any scale in India is the "**Mauritius Hemp.**" This is established in the extreme S. W. of India; in N. India it has recently been used for fibre with other **Agaveæ**; but it is not known to what extent it is in cultivation for this purpose; the identification of this species is considered in the Descriptive List under **Furcræa.**

SUMMARY OF USEFUL SPECIES IN INDIA.

To sum up as regards Indian economic species of **Agave,** those at persent known are E,—F,—G,—J of the Descriptive List;—

E. is **Agave Cantala** *Roxb.*

G. is **A.——sisalana** *Perrine.*

J. is **A.——vivipara** *Wight*, which we have called instead **A. Wightii.**

"**F**" unfortunately is without a name for the present. It seems intermediate between **A. Cantala** and the **Sisalana** series, and would probably repay investigation.

SUMMARY OF USEFUL SPECIES IN INDIA.

We suspect that "**H**" (the large species wrongly called "*lurida*" at Saharanpur) is also allied to the **Sisalana** group,—and careful experiments upon its fibre are very desirable.

"**J**" will doubtless hold its own as a hedge plant, especially in the drier provinces, but the shortness of the leaf handicaps it as against other species.

We know nothing really about **A. Vera-Cruz (D)** as regards its fibre, but the prickly margin of the leaf has to be reckoned with. This species stands a moist atmosphere rather better than **A. sisalana** possibly, but the species "**H**" is perhaps the most adaptable to varieties of climate. We do not pretend to offer an opinion as to soils for planting **Agave**, but botanical considerations, as well as experience in the different gardens, suggest that the composition of the soil is not of much importance,—always provided it is well drained and sloped, or elevated sufficiently to guard against water-logging. An important factor, of course, in the cultivation of **Agave** or **Furcræa** is the provision necessary to meet the effects of poling; but where space is available this can be met by marking out the plantation into blocks, and planting these on a fixed working plan in successive years, so as to maintain a continuous supply of leaves of the proper age from the different blocks in rotation.

In a letter from the State of Vera Cruz the following remarks on the native soil and climate of the **Agaves** occur:—"In our rich clay loams here with 125 inches of rain distributed over nearly nine months of the year—as might be expected—Agaves are non-existent," but it is added, that "on the Pacific side of the Isthmus, * * in the State of Oaxaca, where the rainfall dwindles away to 30 or 40 inches with over eight months' dry season, and a gravelly or rocky soil, I have observed Agave and Cacti in abundance." This lends confirmation to Mr. Cameron's suggestions; but the merit of such situations probably depends on their facility for drainage.

Our reasons for including "**K**" in the List will be found in the following Part (II) of this paper. It is the **A. decipiens** of *Mr. J. G. Baker* which is possibly the same as **A. Ixtli** of *Karwinski* and is known in Florida as "**false Sisal.**" It is only known in India in Botanical collections at present.

PART II.—HISTORICAL AND SYSTEMATIC.

AGAVES ARE AMERICAN.

The genus **Agave** was founded by *Linnaeus* on a species which he introduced into the University Garden at Upsala. From an MS. work of his in Swedish, printed at Upsala by T. M. Fries in 1899, it appears that a specimen of the plant which he afterwards described as *Agave foliis spinodentatis mucronatisque* in the *Hortus Upsaliensis* (*Stockholm, 1748, p. 89*) flowered at Noor between Stockholm and Upsala in 1708 and in this MS. ("*Hortus Uplandicus*") *Linnaeus* identifies the plant that flowered at Noor with the *Aloe ex America* of *Dodoens* and the *Aloe folio in oblongum aculeum abeunte* of *Tournefort.* These synonyms among others are given in the *Hortus Cliffortianus* (*Amsterdam 1737*) for the plant to which he subsequently gave the name of **Agave americana** (*Sp. Pl. ed. 3, 1764, Tom. I. 461*). We will return to the **Agaves** in Clifford's garden later, observing meantime that when first imported into Europe from the New World, **Agaves** were classed by the science of the day with the *Aloe* of *Dioscorides* (or "*Bitter Aloe*") owing to the similarity of foliage.

The first use of the name.

It has been questioned (*Bertoloni Fl. It. IV. 157, also Visiani Fl. Dalmat. I., 124*) whether the **Agave** which has become widely naturalized in S. Europe was in fact imported and not actually indigenous; but the evidence against any **Agave** being a native of Europe is overwhelming.

Some have questioned American origin.

The ingenious argument of *Ernst Meyer* (*Bot. Zeit. 25, April, 1856*) turns on a drawing made in the 15th century, or earlier, of a plant said to occur in India, Persia, Greece, and Apulia in a work on Simples composed by one *Mathias Platearius*, principal (in the 11th century ?) of the Medical School at Salerno founded by Charlemagne; but it is difficult to distinguish figures of *Aloe* and *Agave* in the old authors when, —as *Herr Meyer* states was the case with the Salernian drawing, —no inflorescence is given. Probably a species of *Aloe* introduced by the Saracens into S. Italy was intended. The **Agave** is known in Calabria and Sicily by different names, of which one at least is derived from the Arabic "*Sabare*" * which is still the designation of the *Bitter Aloe* in the North of Africa.

* From a root meaning (inter alia) "to turn sour or bitter," or from a derivative that means "arid rocky places," which the best medical Aloe inhabits.

AGAVE. ITS LIMITS IN AMERICA.

That the genus **Agave** has its head-quarters in the New World is quite certain. *Mr. W. B. Hemsley* (*Introduction to Biolog. Centr. Amer. App. p. 272*) gives the range of the true **Agaves** as from Texas and Arizona on the North to Southern Mexico, with outlying representatives. He further indicates that the type diminishes as one passes out of Central into S. America.

If the group of which **Agave virginica**, *Linn.*, is a type be not made a separate genus (**Manfreda** *Salisb.*) then the north-east limit of **Agave** would be found in the State of Virginia, the most southerly record being one which may be translated as "at the bottom of warm cañons in the province of Huanaco in Peru" (*Ruiz and Paron. III, 66-67*) that is about nine degrees south of the Line in 75° W. Long.

Humboldt does not say that they are wild over the whole of Trop. America.

The authority of *Humboldt** has been long quoted for the statement that his *Agave americana* extends over the whole of tropical America to 7,600 feet from the sea level, but the student has as a rule been left to discover for himself that the **Agaves** which *Humboldt* observed abundantly in Central America were always cultivated, that (as he expressly states) there are several varieties in Mexico, also that the **Maguey** of the Spanish colonies included several sorts some of which (for reasons given in his text) probably belong to other genera.

All this is very clear from *Humboldt's* own writings, but, as the point is of importance, we may add the testimony as to S. America of *Martius* (*Flora Brasiliensis*, III. 1. p. 183) that the *Agave americana* was not even cultivated in Brazil in his time except in gardens or about mansions (*Cf. also W. B. Hemsley loc. sup. cit., p. 273* for remarks on the distribution of **Agave** and **Furcræa**).

GROWTH OF EUROPEAN KNOW-LEDGE.

Hernandez.

Humboldt remarks that the several varieties of the "**Agave americana**" constitute the **Maguey** or **Metl** of the Aztec-speaking peoples. **Metl** evidently was a general term applied to different **Agaves** (and **Furcræas**) as well as to certain useful plants of the Pineapple Family **(Bromeliaceæ)**. This appears from *Hernandez* (*Rer. Med. N. Hisp. Theasaurus a Nardo Anton. Recchо Collecta, etc., Romae 1651*) *Hernandez*, who was body physician to Philip II of Spain, had spent a

* The most important statement is in the "*Essai Politique*" and is translated at some length in the letterpress to plate 3654 in Curtis's Botanical Magazine, Vol. XII, N. S. 1839.

great part of his earlier life in the Mexican possessions, and was manifestly a close and intelligent observer.

AGAVE. GROWTH OF EUROPEAN KNOWLEDGE ON MAGUEY.

The *Thesaurus* (Cap. XII) gives about twenty different sorts of *Metl* with woodcuts of nine which, though rough, are usually good, but in the case of "*Maguei*" the inflorescence seems to have been added wrongly, as the flower is not that of an *Amaryllidea* at all or indeed attributable to any allied order. This is repeated by *Morison* (*Plant. Hist. Oxon. ed. 1680 p. 417 and t. 22 Sect. 4*), for his "*Aloe* (3) *americana flore luteo.*" His letterpress is largely taken, as regards the "American Aloes," from *Hernandez.*

16th Century.

The earliest mention of the **Maguei** that we have been able to trace is attributed to *Peter Martyr* (*De Rebus Oc. et Orbe Novo, Basel*, 1533) as quoted by *Martius*, l.c., p. 192 and by *Danielli, Nuovo Giorn. Bot. Vol. XVII, Fasc.* II, *April 1885.*

Peter Martyr.

Peter Martyr seems to have known the plants, which were produced in San Domingo; he compares them to palms, and says that the inner leaves were eaten by the natives. He further states that the name in the Haitian language signified a drum (or cymbal?). In the older books it is noted that a kind of parchment or paper was made from the leaves of **Agave**, so it is possible that *Peter Martyr* was mistaken, and that the tambourines of the Haitians were called after the **Agave** and not, as the quotation suggests, the plant from the instrument.*

Oviedo (v. *Martius*, also *Danielli*, ll. cc.) in the 16th century mentions at least three kinds of fibre-yielding plants of the West Indies, viz.:—

Oviedo.

(1) **Henequen**, (2) **la Cabuja**, (3) **Maguey.**

Martius (*Beitrag zur Natur-und Literatur-geschichte der Agaveen*) has gone fully into *Oviedo's* account and regards four species as indicated; he concludes that the **Maguey** Agave was not "*A. americana*" (of *Humboldt* and others) but a species of the Islands which he specifies as "*Agave vivipara.*" He quotes a passage in which *Oviedo* refers to the Maguey of the Mainland, and this seems to support the conclusion that the species of the Islands from which soap and fibre are obtained differed from the Maguey of Mexico.

From 1568 to 1572 an Englishman named *John Chilton* travelled over nearly the whole of Central America and in his

Chilton.

* *Zambarone*, one of the names of **Agave** on the Adriatic littoral, which is usually regarded as a corruption of the Saracenic term already mentioned, looks more as if it might be derived from the oriental name of the Kettledrum or Turkish cymbals (Zambúr). The Apaches (Northern Mexico) use the central shoot of a species of *Agave* for making fiddles [Miss. Gard. Rep. VII p. 58].

AGAVE, GROWTH OF EUROPEAN KNOWLEDGE ON MAGUEY.

account (see "*A notable Discourse, etc.,*" *in Hakluyt's Voyages, London, 1598, Vol. III., p. 462*) it is noted that, "*about Mexico and other places in Nova Hispania there groweth a certain plant called Magueis which yieldeth wine, vineger, hony, and blacke sugar, and of the leaves of it dried they make hempe, ropes, shooes which they use, and tiles* for their houses, and at the end of every leaf there groweth a sharp point like an awle, wherewith they use to bore or pearce thorow anything.*" Hawkes.

Hawkes, a merchant who resided in New Spain about the same period (*l.c.* p. 463) also mentions the "*Magueiz*" as the source of a wine which is called "*Pulco.*" In 1601 *Hakluyt* published a translation of the "*Descobriomentes*" (published 1563) by *Antonie Galuano* who was Governor of the Portuguese East Indies in the earlier half of the 16th century. This contains a full account (among other wonders of New Spain, such as the Humming Birds) of the **Metl** or **Honey Tree,** which is unmistakeably the **Maguey** or **Metl**† of *Humboldt.*

Galuano.

Lopez.

F. Lopez de Gomara (author of the *Life of Cortes*) gives a similar but more exact account of the *Metl,* adding that the Spaniards call it *Cardon.*

Acosta.

In his *General History of the Spanish Indies* published about the same period *Acosta* (*v. Danielli, l.c., p. 68. quoting Martius*) describes "*El Arbor de las Maravillas es el Maguey*" as a *Peruvian* species differing from that of New Spain (*i.e.* Mexico).

One Maguey or Metl in one place another in another.

From these different histories it is clear that one kind of **Maguey** was known in San Domingo and other West Indian Islands from the time of their discovery by Europeans, and that different plants, probably **Agaves** or **Furcræas,** which were employed for various economic uses on the mainland were identified with the Island kinds by the Spanish ‡ conquerors, of which the best known was the wine-producing **Metl** of the Mexicans. As has been noted, however, there were several kinds of **Metl.**

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* This use is noted in the *Canaries,* where **Agave** is naturalized, by Leopold von Buch (*French translation of Chap. IV. of the main work reprinted from Archives de Botanique after 1817*).

† The early writers, whose etymology was comprehensive, clearly connected this Aztec appellation with the "honey" which distils in the perianth of different species of Agaveae.

‡ This was written before we had seen Martius' "*Beitrag, etc.,*" in which he arrives at a similar conclusion.

AGAVE, APPEARS IN S. EUROPE.

The Spanish conquests in Central America were established by the year 1525 and not long afterwards at least one species of **Agave** had appeared in S. Europe.

16th Century.

Charles de Lecluse (*Clusius*) while travelling in Spain about the third quarter of the 16th century saw a plant growing in a convent garden near Valentia, which he has described as *Aloe americana* (*Rariorum Stirp. per Hisp. 1576*; also *Rar. Pl. Hist. Antwerp, 1601, p. 160*), and identifies with the *Metl* or *Maguey* of *Gomara*, whose account he incorporates. *De Lecluse* took offsets from the convent specimen (which had not yet flowered) and sent one of these to a friend's garden in the Netherlands. *M. Charles Martins* (*Bull. Soc. Bot. de France, II., p. 9*) notes that the woodcut in the *Historia* was taken from the specimen that was sent to this friend and that this subsequently flowered at Antwerp. This figure gives a fair representation of an **Agave** of the type of *Humboldt's* "*americana*."

Clusius found it in Spain, sent it to Netherlands.

Caesalpino. Found it in Italy.

Almost simultaneously or a little later, *Caesalpino* saw an **Agave** in flower in the garden of the Bishop Tornaboni, probably near Pisa, which is eloquently described in Cap. XXXII of his "*De Plantis*" as "*Alterum genus* [viz.: *Aloes*] *ex India Occidentale advectum etc.*"

These canno be identified

Danielli says, with much justice, of the accounts which occur from this period with increasing frequency of "*Aloe americana*" having flowered at such and such a spot in Europe, that it is impossible to say which of the species of **Agave** (Sect. *Euagave*) was seen by the observers; but *Caesalpino's* excellent description suggests that the specimen he saw was not **A. americana** of *Linnaeus.*

Cortuso, grew one in Italy.

Cortuso, Superintendent of the Botanic Garden at Padua, had an **Agave** in cultivation before 1561, which is said to have been the first introduced into Italy (*not* Europe, as by a slip,—often pointed out,—was stated in the *Species Plantarum*).

France received plan probably from Italy.

The story that the **Agave** first flowered in Europe at the papal city of *Avignon** in South-Eastern France in 1599, seems to rest upon a pious opinion, of which the genesis can be divined by consulting the original authorities (for references see Danielli, l.c., pp. 84—85, and Ch. Martins, l.c., 9 to 11).

* *Danielli* notes that the **Agave** was probably taken by Italians settled in Avignon to that city from Tuscany. In a French work on the plants of the Trianon garden it is said that "A. americana" was first brought to Paris from the Mauritius in the 17th century.

AGAVE SPREADS IN EUROPE.

An account by *Pierre Borel*, a Languedocian who was some time physician to Louis XIV ("*Hortus * * * cum accurata descriptione, etc.*," *Castries 1666 Paris 1669*) hasbeen the source of sundry evergreen traditions about "*Agave americana.*" Borel is quoted in the *Historia Plantarum* (*London 1686*, p. *1198*) as follows:—

Borel had it near Montpellier; his account of its polling.

"*Petrus Borellus Aloe plantæ caulem cum perl ongum tempus sine eo remanserit tandem erumpere scribit cum fragore et strepitu ut impetu facto tota in truncum fere convertatur coram mirantibus hominibus incrementum tantum suscipere ut etiam Quercum mediocrem aequet et 30 circiter palmarum altitudinem, et femoris crassitiem acquirat, floribusque in summitate decoretur. Quodque magis mirandum intra paucos dies* [*quatuor vel quinque*] *hanc molem attingere, adeo ut incrementum ejus etiam oculis percipi potuit. Tale quid visum nuper apud Monspelienses etc. credat Judaeus Apella.*"

The last three words are not, of course, in Borel but are *Ray's* comment, and produced later dissertations; but the facts collated by *M. Charles Martins* (of Montpellier), *Danielli* and others shew that the flowering of different species of **Agave** (Euagave) in Europe may be delayed from the sixth to the eighty-second year of the life of the individual offset.

Borel's specimen flowered at Pezénas near Montpellier during 1641 and the then King of France with Cardinal de Richelieu and the whole Court went to view it. This climate is that, in all Europe, perhaps most congenial to the **Agaveae**, and in the adjoining Sub-Pyrenean County of Rousillon, more especially about Perpignan, an **Agave** is naturalized on a great scale. (*Le Grand in Bull. Soc. de France, XVII, p. 95.*)

Camerarius boldly considers to be one Clusius' plant of Spain and Netherlands. Tuscan plant, and Linnaeus A. americana.

Bock (*Tragus*) about 1552, and *Mattioli* in the 1563 edition of the *Kreuterbuch* make no allusion to any plant that could be an **Agave** or **Furcræa**, though they deal fully with "*Aloe*," but in *Camerarius'* edition of the *Kreuterbuch* (*Frankfurt am Main*, 1590) *Aloe americana* is described and two illustrations are given. The letterpress is taken from *Cæsalpinius* and *Clusius* almost bodily, but it is expressly noted that the plant had come to North Europe from the West Indian Islands, though the usual identification with the **Metl** of the American Continent is added. One of the figures appears to be copied from *Clusius*, with an addition which will presently be noted. The other shows a flowering **Agave** in a gardener's "tub," which might be almost any of the **Euagave** section. This was sent by a correspondent in Italy to show how the American Aloe "poled" in Tuscany.

The addition to the figure borrowed from *De Lecluse* represents the terminal spine of an **Agave** which can only be that known in English gardens now as **Agave americana**. A flower is figured in the margin of the Florentine drawing, which was probably meant to be of the natural size, but this does not agree with either of the species which we suppose to

have been up to that time introduced into South Europe. *Camerarius* has helped a good deal, we think, to perpetuate the general assumption that the **Agave** which has been long cultivated in N. Europe (**Agave americana** of *Lingaeus*) is the same species as that which has run wild on the Mediterranean littoral.

AGAVE SPREADS IN EUROPE.

Kaspar Bauhin ("*Pinax, etc.*" *Basel, 1671, p. 286*) gives under *Aloe* (*1*) *Vulgaris*, (*2*) *Aloe folio in oblongum aculeum abeunte*, quoting for the second *Aloe americana* of *Clusius* and *Aloe alterum genus* of *Cæsalpinius*. Up to this time authors were contented to distinguish what we now call **Agave** from the true **Aloe**, and when further kinds began to be discriminated the definitions did not aim so much at sorting out the species under either genus, but referred to "*Aloe vulgaris*" as the point of departure, which has led to no little difficulty and misunderstanding.

K. Bauhin quotes a work by Linschoten on the East Indies (which we have not been able to consult) for his second *Aloe*, but it appears from other sources that Linschoten saw or heard of that *Agave* in Africa or the Atlantic Islands.

AGAVE APPEARS IN THE EAST INDIES.

The earliest reference to **Agave** in the East Indies that we have traced occurs in a book which professes to contain notes by a pupil of *Boerhaave* of lectures delivered by that acute student of nature towards the close of the 17th century at Leyden. This indicates that a species of **Agave** was by that time established in the Dutch East Indies where it was planted chiefly as a means of keeping out intruders.*

From this work it seems that *Boerhaave* (who taught a system based in the main on an embryological foundation) placed the genus "*Aloe*" in his class of "*Monocotyledones bracteatæ*" and recognized in all six species, of which No. 3 was the true *Aloe* from the island of Socotra (for which see *Bailey Balfour, Botany of Socotra, Edinburgh, 1883*). Nos. 1 and 2 were also species of **Aloe**. From the virtues attributed to the fifth and sixth kinds they were evidently **Agavse** (or **Furcræas**) and American. Of the fourth it is said—

"*Quarta laudatur pro summo nutrimento in usus humanos, uti incolae testantur circa Mekiam, crescit in ingentem altitudinem folia rigidissima habet. Hae pro muris in propugnaculis inserviunt*

First in the spice islands.

* *Galuano* (v. sup) makes no allusion to any **Agave** as introduced in his time into the E. Indies.

AGAVE APPEARS IN THE EAST INDIES.

arcendis praedonibus, totum folium spinosum & filamentosum est nostratibus Naeldendraet, succus ex calice est edulis et nutrit ut rapa."

Mekia or Makian is a volcanic island about half a degree north of the Equator in 127° E. Long.,—the most southerly of the Ternate group, the original Moluccas or Spice Islands. In 1605 the Dutch expelled the Portuguese from the Moluccas, and in 1664 the Spaniards who had occupied Tidore surrendered that also. In the meantime the colony on Makian had been destroyed and scattered by a great eruption and earthquake in 1646, but the island was reoccupied after a few years, only to be laid waste again some twenty-five years later. We know that there were two ports on the South Sea coast of New Spain for trade with the Philippines and Moluccas, and that ships were built at one of these expressly for the South Sea navigation; so that plants from Mexico might easily find their way to the East Indian Archipelago in the 17th century, but it is remarkable that *Valentyn* ("*Amboyna*," *Dordrecht, 1726*) makes no allusion to the **Agave** though he includes in his List of native and cultivated Trees and Plants the *Lidah Boaya* (*i.e.* Alligator's Tongue) or true **Aloe.**

Rumpf (*Herb. Amb. V. pp. 271—274, tab. XCIV*) gives a full account of *Lidah Boaya* as "*Sempervivum majus indicum*" which he introduced into *Amboyna* in 1661, and notes that it differs from the *Aloe americana* of *Clusius* 'that being more akin to *Pandanus*'. "*Sempervivum*," it may be noted, was a name applied, it is said, to the true **Aloe** by the traders of Antwerp, who often kept a plant hanging from their roofs as a curiosity.

Burmann—the editor of the *Herb. Amb.*—adds a later note by *Rumphius* dealing very fully with another succulent plant that was first brought to his notice in a deserted plantation (near Amboyna apparently) in 1697, but was spreading in the Colony. The natives called it *Nanas utan*, *i.e.* 'woodland (or wild) pineapple,' or *Nana boaya* (Bwaya = crocodile in the Malay lingua franca, *v. Crawfurd,* etc.) and said that it had been introduced from Macassar.—*Rumpf* compares his plant, of which the figure as regards the general habit is excellent, with the *Aloe americana* of *Clusius* which he knew only by description, noting at the same time that there are discrepancies between his living plant and the description which may be due to climate or casual variation.

The note concludes by remarking that the plant seems to multiply by proliferous gemmation (*i.e.*, from what he calls the second sort of flowers or false blossoms) or by suckers or in either manner, but his observations could not be completed, for which he gives reasons. AGAVE APPEARS IN THE EAST INDIES.

Rumpf's plant we consider is an **Agave** that is established as a denizen in India, and is markedly distinct from the species naturalized in S. Europe, as well as from the true **Agave americana** of *Linnaeus*, namely **(E)** of our Descriptive List—**A. Cantala**, Roxb. This plant not the same as those then in Europe.

We must now return to the "American Aloe" in Europe. *Hermann*, Professor of Medicine and Botany at Leyden, in his Catalogue of the Botanic Garden there (1687) enumerates five species of *Aloe* of which three are true Aloes, one is the "*Aloe folio in oblongum aculeum abeunte*" of *K. Bauhin's Pinax*, while the fourth from the figure (at p. 17) is an Euagave which he describes and calls *Aloe americana sobolifera*. It was brought from America and flowered in a private garden at Harlem shortly before the compilation of the Catalogue. KNOWLEDGE IN RAY'S TIME.

In the *Historia Plantarum* (*Lond. typ. Maria Clerk, 1688, pp. 1195—1201*) *Ray* describes four species of the true *Aloe*. He then deals with *Aloe americana* and distinguishes, Ray's enumeration.

(1) *Aloe americana*, Clusius
(2) *Aloe americana minor*, Munting
(3) *Aloe serrata major umbellifera*, Munting
(4) *Aloe purpurea laevis*, Munting
(5) *Aloe brasiliensis* (=*caraguata*) Markgraf.

Three species of *Caraguata* (all of Markgraf*) follow, and the chapter concludes with

(6) *Aloe ferox*, Munting

Ray's succeeding chapter discusses certain species described by *Hernandez* (v. supra) under Mexican names which *Ray* considered (though not without doubt in some instances apparently) to be referable to the group (so to speak) of *Aloe americana*. Two of these had been included in the previous chapter (VII).

Before discussing the identity of *Ray's* species it will be convenient to refer to certain other authors, mostly his contemporaries. *Plukenet* (London, 1696)

* We have not made extracts from the works of *Piso* and *Markgraf* (*ed. De Laet, Amsterdam ap. Elzevir. 1658*) because all that is important in their writings can be traced in works ordinarily more accessible.

AGAVES DISTINGUISHED IN RAY'S TIME.

has enumerated (besides *Aloe palustris anglicana* which is = *Stratiotes aloides* Linn.) twenty-two *Aloes*. Out of these there are eight belonging to genera other than Agave or Furcræa which are chiefly true Aloe and received mostly from Africa.

By Plukenet.

His first species "*Aloe perrara Andalusiae*" was obtained from the South of Spain and does not appear to have been taken up subsequently. The remainder seem to be species (or at least forms) of Agave and Furcræa: of *Ray's* species he appears to include the following,—

(1) *folio in oblongum aculeum abeunte*
(2) *Theometel*
(3) *serrata major umbellifera* (Munting)
(4) *purpurea laevis* (Munting)

also the *Caraguata guaçu* of *Ray*, for which however he quotes *Piso* and calls the plant *Aloe americana spinifera*, ignoring seemingly the *Caraguata* and the *Caraguata açanga* of *Markgraf*, which *Ray* had distinguished. He has evidently merged *Ray's* No. iii *serrata umbellifera* of *Munting* in his *americana sobolifera* for which he quotes *Hermann* (v. sup.).

He throws some doubt on *Ray's* identification of *Hernandez'* "*Metl lenissimum*" on grounds which hardly seem forcible. A variegated kind of *Aloe americana* is mentioned which was evidently regarded as a form of "*sobolifera*." "*Aloe americana radice tuberosa fœtida major*," = *Pit* or *Pita* of *Parkinson*,—is quoted as being the "*Piet* of the natives" [*i.e.* of the West Indies] and a picture is given in the *Phytographia*. Two varieties are mentioned, one with marginal spines, the other spineless, of which the latter is perhaps a *Furcræa* (*F. giguntea* Vent. ex. *Martius Fl. Brasil. III. p. I. 187.*)

Parkinson's "*Aloe americana foliis cæsiis latioribus*" is doubtfully identified with the "*Aloe americana ex Vera Cruce foliis latioribus glaucis*" of the *Hortus Beaumontianus*. We have not been able, unfortunately, to see figures of either, but the brief descriptions pretty surely refer to one or other of the glaucous Euagaves that are now diffused in Europe.

By Tournefort.

In the "*Institutions*" (Lyons ed. 1706) *Tournefort* has a figure which contrasts the flower of Agave, with that of the true Aloes, but he got no further, and his list of species does not differ materially from that of *Plukenet* except that it is briefer.

By Sloane.

In 1696 *Sir Hans Sloane*, a Fellow of the Royal Society, and afterwards its President, published his *Catalogus Plantarum* as the result of travel, chiefly in the West India Islands. The plants enumerated are those of Jamaica principally, but the book contains many valuable references as regards the Caribean region generally.

The *Catalogue* gives only four "*Aloes*," viz.—

(*a*) *Aloe Dioscoridis*
(*b*) *Aloe secunda seu folio in oblongum aculeum abeunte*
(*c*) *Aloe Yuccae foliis*
(*d*) *Aloe visci in modum arboribus innascens*

AGAVES DISTINGUISHED. ABOUT RAY'S TIME.

(*a*) is a true *Aloe*, and (*d*) a *Tillandsia* or allied *Bromeliaceæ*.

(*b*) should be *Agave americana* of *Linnaeus*, because *Kaspar Bauhin*, *Clusius* and *Cæsalpinius* are cited for the species, but its identity with the Mexican "**Metl**" or "**Manguei**" is questioned, very full references being given to the Spanish and English authors, who had dealt with the "**Metl.**"

The local name of the Jamaican plant is given as "**Caraca**," and it is said to be frequent on the stonier and drier hills of that island.

Keratto a loose term.

Several accounts of "**Caraguata**" are referred to also, and we may say at once that "**Caraguata**" or "**Keratto**" is a comprehensive name locally applied in different countries to different **Agaveæ**, though usually, perhaps, to certain species of **Furcræa**: but in S. America to sundry **Bromeliaceae** also.

(*c*) is identified by *Sloane* with the **Henequen** of older travellers, and he suggests that it may be one of the "*deux dernieres pites qui n'a des petits picquans aux feuilles comme l'ananas*" mentioned by *Du Tertre*, as well as the "**Pati** *seu* **Metl lenissimum**" of *Hernandez*. Of this he says "*ad margines viarum Insulæ Jamaicæ locis campestribus et sylvosis crescentem observavi.*" *Martius* (l.c.) observes that the name "**Henequen**" belongs to the ancient language of Haiti, and was applied in the Antilles indiscriminately to different species of **Furcræa** and **Agave**, the corresponding Carib term being "**Pita.**" There are other grounds for thinking that the **Sisal Agave** had been already naturalized in the West Indies before its recent re-introduction, and on the whole it seems likely that the **Pati** of *Hernandez* and *Sloane's* **Henequen** represent **Agave sisalana**, *Perrine*.

By the Commelins.

Towards the end of the same 17th century the *Commelins*,—*Jan* and *Kaspar* (uncle and nephew)—were successively in charge of the Amsterdam Garden, and published tracts on different species of **Agave**, the most important for the present purpose being the younger *Commelin's* Excursus in the *Præludia* (*Leyden, 1703*) on a species which he describes and figures as *Aloe americana polygona*, and identifies with *Munting's Aloe americana minor* which is Ray's No. II.

Commelin, relying, as we suspect, on *Ray*, or perhaps *Munting*, who were in their turn influenced no doubt by the drawing in *Hernandez*, says that his plant is the *Theometel* of

AGAVES.

RAY REVIEWED.

the Spanish author. *Mr. Baker* (*Gard. Chron. 1877, vol. VII, p. 200*) keeps up an **Agave Theometel**, *Zuccagni*. *Zuccagni* identified his species with the *Theometel* of *Hernandez*, but *Mr. Baker* remarks that it may be a mere variety of **A. americana** *Linn.*

Ray's first Euagave is A. americana.

Returning now to the *Historia Plantarum*, *Ray's* first **Euagave** is clearly **A americana** *Linn.*, and his second we may take as=**A. Theometel** of *Zuccagni.* In his account of the uses of the first he has not escaped the general confusion, and attributes qualities to the **A. americana** of N. Europe gardens which it cannot claim, but the species that he meant to indicate was that which *Linnaeus* afterwards named "*americana*," although *Clusius* is cited.

His second apparently is A. Theometel.

His third is no Agave.

The third kind of this group rests on a description which seems to be quoted from *Hermann* but is not to be found in the *Paradisus* or the *Catalogue.* This description answers to the woodcut of the "**Maguey**" in *Hernandez*, which as already said cannot be an **Agave.**

Boerhaave (*Catalogue of Plants in the Leyden Garden* 1720) does not refer to it, and from the flowers it cannot be *Hermann's* "*sobolifera*" with which *Plukenet* and others have identified it.

His fourth is apparently A. Sisalana.

There remains the *Aloe purpurea laevis* of *Munting* of presumed Agaves. As already said we think this must have been **Agave sisalana** *Perrine,* though the purple tint ascribed to the edges of the leaves would fit **Sansevieria** better; as it happens, however, the leaves of the bulbils in **A. sisalana** as well as the species **H** of our descriptive list are spotted with violet-purple, which we have not observed in any other **Euagave.**

His first Caraguata and second seem Agaves of section Littaea.

The *first Caraguata* (*aloe brasiliensis*) seems to be an **Agave** of the *Littaea* group; and the second may belong there also.

His third probably a Furcraea.

The third (*caraguataguaçu*) has been usually supposed to be a **Furcræa** and is probably = **Furcræa tuberosa,** *Aiton.*

His fourth a Bromeliad.

The *Caraguata açanga* manifestly belongs to the **Bromeliaceae** and is doubtless, as observed by *Ray* himself, the *Mexocotl* of *Hernandez.*

AGAVES OF LINNAEUS.

In the *Hortus Cliffortianus*, 1737, *Linné* describes certain species of *Aloe* (out of which, as before, we exclude all but those belonging to the tribe or natural order of **Agaveæ**) as **follows:—**

AGAVES OF LINNÆUS.

1. *Aloe foliis lanceolatis dentatis spina cartilaginea terminatis radicalibus* [Synonyms] *A. folio in oblongum aculeum abeunte* Bauh. Pinax [Morison's tab. 22, f. 2 and 3 are also cited; of these fig. 2 is that of *Clusius* without the addition made by *Camerarius*] *Aloe secunda, etc.*, Sloane; *Aloe americana muricata* Bauh. Hist., [and] Boerhaave, *Aloe americana* Besl. Eyst., *Aloe alterum genus ex India occidentale* Caesalp. Syst. 418. *Caraguata guaçu* Markgr. Bras. 87. [A variety is given as *Aloe americana ex vera cruce foliis latioribus et glaucis* Comm. hort. 2 p. 31. t. 16.;—and the native country is said to be "*in sterilioribus aridioribus et saxosis collibus americae jamaicae, etc.*"]

* * * * *

13. *Aloe foliis lanceolatis integerrimis patentiusculis aculeis terminatis radice caulescente* [Synonyms] *Aloe americana viridi rigidissimo et fœtido folio Piet dicto indigenis*, Kiggelaar in Comm. hort. 2. p. 35 t. 18; Boerhaave Lugdb. 2 p. 129. n. 10; *Aloe americana tuberosa fœtida major Pit Pita* Herm. Prod. 306; *Aloe americana radice tuberosa minor* Pluk. Alm. 19 t. 258 f. 2. [Native country] *Curaçao.*

[A variety is described as *Aloe americana foliis angustioribus ex Vera Cruce. Hort. Carol. 4.*]

The figure cited under 13 from the Phytographia * is referred in the Almagestum (p. 19 as cited by Linnæus) to "*Aloe americana radice tuberosa fœtida major Pit Pita P. B. P. * * * Eadem minor non spinosa*" which *Plukenet* identifies with *Aloe americana viridi rigidissimo et fœtido folio Piet dicto indigenis* of the Hort. Beaumont, but these identifications cannot be relied on, and all that can be said is that *Linnaeus'* Harlem plant was pretty certainly a spineless *Furcræa.*

The two confused plants of Europe.

With respect to 1, it is a fair inference that *Linné* looked on the two distinct plants that are often included under *Agave americana* on the continent of Europe as forms of one species.

We have not been able to inspect ** the figure published by the elder *Commelin*, but there is every likelihood that the glaucous variety of Clifford's collection was the type known in the Calcutta Garden as *A. lurida* and long supposed to be identical with the *Agave lurida* of *Aiton's Hortus Kewensis.* This garden possesses plants received from the great collection of *Sir Thomas Hanbury* at *La Mortola* as *Agave lurida*, which appear to us

* What follows applies to the only copy to which we could refer:—the "*Eadem minor non spinosa*" is what we should now call a subspecies, made by *Plukenet* himself.

** Since seen: it is evidently *Agave lurida* H. B. C. = **A. Vera-Cruz, Mill.**

AGAVES OF LINNAEUS.

The two confused plants of Europe.

to be identical with the Calcutta *lurida*:—and this is the species which we understand to be naturalized in South-Eastern Europe and North Africa; though in Spain, and possibly in Algeria (where a second **Agave** is distinguished by the French Botanists as "*A. mexicana*)" other species may have run wild.

One will be here called A. americana L. The other A. lurida. H.B.C.

*Brotero** (*Fl. Lusitanica*, p. I. p. 539) says "*In Algarbiis nunc ad sepes aliam Agaves speciem colere inceperunt foliis saturate viridibus minus crassis florentem non vidi an A. vivipara L.? an mexicana Lam.?*"

Without careful examination on the spot it is impossible to clear up these points, but there seems small likelihood that the **Agave americana** of the "*Species Plantarum*" has run wild anywhere in Europe or Asia. The "*lurida*" of La Mortola is usually called in Gardens of the South of Europe "*A. americana*" or "*A. mexicana.*"

To distinguish the plant (allied to the true **americana**), which is naturalized in India and (as we believe) in S. France, in parts of Italy,—on the Dalmatic shore,—in the Mediterranean Islands and in N. Africa,—this will be referred to for the present as "*A lurida H. B. C.*", to distinguish it from the true (cultivated) **A. americana** *Linn.*, and the different garden varieties of the latter.

At the time *Linné* compiled the *Hortus Cliffortianus* he had seen only a few specimens of **Agaveæ** in gardens, for he writes:—

"*Flores dum explicat spectatores tanquam ad portentum allicit, at absoluto brevi gaudio perit planta radicibus.*"

One of several shoots may may flower and die.

Closer opportunities have taught later observers that it is only the one shoot which flowers that is exhausted, and that in a vigorous example several shoots may come to maturity and flower in succession. Conversely, under certain conditions, several branches from the main stem may "pole" simultaneously (*Bull. Soc. Bot. de France* III. *Rev. Bibl. p. 205; also* VI. *p. 187*).

Agave† was first distinguished in the *Hortis Upsaliensis* (*Stockholm, 1748. p. 87*), but the genus dates technically from

* It should be noted that *Brotero* does not seem to have been aware that the mode of flowering in **Agave** is very different from that which prevails in **Aloe**.

† *Linnaeus* states that he selected the name (v. Hort. Upsal. l.c.) thus "*Africanae et Asiaticae*" [viz., Aloes species] "*utpote officinales, diutius notae*

the sixth edition of the "*Genera Plantarum*" (*Stockholm, 1764, No. 431 p. 171*). In the *Species Plantarum Ed. 1. Vol. I. p. 323 (Stockholm, 1753)* there are four species of **Agave** named and described on the Linnæan system, viz.:— AGAVES OF LINNAEUS.

1. *A. americana*
2. *A. vivipara*
3. *A. virginica*
4. *A. fœtida*

No. 3 may be dismissed at once. It has never been known in India out of a Botanic Garden,—it yields no fibre, and belongs to a group so different in vital respects from the **Euagaves** that it has been more than once proposed to separate the group to which **A. virginica** belongs as an independent genus. No. 3 hardly known in India.

A. fœtida is No. 13. of the *Hortus Cliffortianus* and is currently identified with **Furcræa gigantea**, *Vent.* How far this is a correct identification may be left for the present.

No. 1 *A. americana* does not call for any long discussion either. The plant which *Linné* had seen, and knew—founding his genus **Agave** on it,—was undoubtedly the **Agave americana** L. of *Andrews' Repository* (*London, 1799—1811, Vol. 7, 433* †) and of the *Botanical Magazine*, *No. 3654* (*Vol. XII. N.S. London, 1839*), so far as the pictures and the technical descriptions are concerned. No. 1 known alive by Linnaeus.

The Jamaican habitat given in the *Hortus Cliffortianus* is omitted, and the *Vera Cruz* variety which found a place there also.

It is said of **A. americana** "*Ex ea hodie sepes in Lusitania*," and it is probably in consequence of this remark that the species which is largely naturalized in S. Europe is often, if not usually, called *A. americana* on the continent.

The second species, *Agave vivipara*, clearly was not known in a living state to *Linnaeus*. The description is "*Foliis dentatis staminibus corollam æquantibus*," which was taken probably from the plate in *Commelin's* Praeludia, already quoted, of "*Aloe americana polygona*" cited by *Linnaeus* as No. 2 not known alive by Linnaeus.

retineant nomen officinale et usitatissimum; aliud his" [viz., Agavæ speciebus] "*imponatur, inter synonyma nullum dignum occurit, licet antiquo generi antiquum nomen competeret, ideoque dixi Agave quasi plantam admirabilem.*" It is usually stated that the name is derived from a Greek adjective meaning "wonderful," but Linnæus probably did not forget the Amazon or the other mythological personages of whose existence we are reminded by *Danielli* (l.c. p. 69 annot. 2).

† On the plate by an error CCCCXXXVIII.

AGAVES OF LINNAEUS.

His No. 4.

a synonym for his *vivipara*. In the text of *Commelin* nothing is said of the stamens being equal to the corolla; and it is expressly stated that the *Aloe americana sobolifera* of *Hermann*, which *Linnaeus* excludes altogether but compares with his *vivipara*, is a totally different plant from the *polygona*.

Commelin is positive that his *polygona* is the *Aloe americana minor* of *Munting* and his engraving corresponds with *Ray's* description (based on the *Aloidarium* presumably), but the further identification with the *Theometel* of *Hernandez* rests on the statement of a ship's captain who had brought the plant to Europe as a febrifuge with the native name *Theometel*, which *Hernandez* had rendered as "*Maguey divinum.*"

Wight mistook it.

Aloe americana minor, however, from the description would seem to differ from the plant which is figured by *Wight* (*Icones, 2024*) as naturalized in India and referred to the Linnæan "*vivipara.*" *Wight's* species, which is at once recognizable from other **Euagaves,** has a strong likeness to a rough sketch in *Hernandez,* but this is not his *Theometel.*

In the 2nd ed. of the Species Plantarum, *Linnaeus* added as a further synomym for his "*vivipara*" *Aloe americana, Rumph. 5. p. 273 t. 94. Rumpf* did not intend apparently to identify his plant with that of *De Lecluse,* but in any case it is certain that they are perfectly distinct whether what *De Lecluse* saw was **A. americana** of *Linnaeus* or another species. If *De Lecluse's* drawing was taken from an offset, as is stated, it was probably = *A. lurida H. B. C.*, but it is difficult to separate young plants of this from true **americana**.

Linnaeus thought Rumph's Amboyna plant his No. 2.

Following the later editions of the *Species Plantarum*, the real plant of *Rumpf* has been often called *Agave vivipara*, especially in the East Indies.

Dillwyn made Sherard's plant to be Linnaeus' No. 1.

In the *Hortus Elthamensis* (*Amsterdam, 1774*) *Dillwyn* figures a plant in *Sherard's* garden (in England) which is styled on the plate "*Aloe barbadensis mitior laete virens et splendens*"; in a List in which the plants are harmonized with the *Species Plantarum* this is reduced to *Agave americana* of Linnæus.

If the identification be correct and the specimen came from Barbadoes this would shew that the true "**americana**" was then in the West Indian Islands, but the drawing is indifferent.

JACQUIN'S A. LURIDA.

In the fourth volume of the *Collectanea* (*Vienna, 1790, p. 94. t. 1*) *Jacquin* figured and described his *Agave lurida*, which he identified with a species published under that name in the *Hortus Kewensis* of *Aiton* (*1st ed., London, 1789*), at the same time stating that it was well known in Botanic Gardens as the

Aloe ex Vera Cruz, but had flowered for the first time at Schönbrunn, where it had been received in 1753 from Holland. JACQUIN'S A. LURIDA.

The description does not quite fit any **Euagave** with which the writers are acquainted; the coloured figure shews a plant* which, whatever it may be, is not **A. americana**, *Linn.*, nor *A. lurida* of the *Calcutta* Garden. It may be presumed that the *Vera Cruz Aloe* of gardens was either identical with the *Aloe ex vera cruce*(1) of the *Hortus Cliffortianus* or was so far like it that the two were identified. *Aiton* (*in the 2nd edition*) does not say that his *Agave lurida* was the *Vera Cruz Aloe* of *Miller*, but he quotes *Willdenow* who took his *A. lurida* from *Aiton's* 1st edition and *Willdenow* gives two varieties, of which *foliis latioribus* is expressly said to be the **Agave Vera Cruz** of *Miller*. *Willdenow* arranged his **Agaves** under two groups—*Acaules* and *Caulescentes*,—*lurida* being in the latter. Willdenow thought this conspecific with A. Vera-Cruz.

Turning now to *Miller* (*Gardener's Dictionary, VIII ed.*) who, though he made full use of the Linnæan genera, adhered in the main to *Ray* and *Tournefort*, we find three **Agaves** of the Species Plantarum, viz :— MILLER'S EIGHT AGAVES.

1. *A. americana* 2. *A. fœtida* 3. *A. vivipara*

He had No. 3 in cultivation and describes it as *foliis reflexis marginibus dentatis*, and identifies it with the *Aloe sobolifera* of *Hermann* without hesitation, though *Linnaeus* was doubtful and *Commelin* says flatly that they have nothing in common. *Willdenow* had concurred with *Commelin*, at the same time questioning *Linnaeus'* citation of *Rumphius*. His vivipara is not Wight's Indian vivipara.

We may say at once that the *Agave vivipara* of *Miller* must be utterly distinct from the plant of *Wight's Icones*.

Miller's second species is *Agave* (*virginia*)† which is altogether different from *Linnaeus' A. virginica*.

The following plants not known to *Linnaeus* are common to *Miller* and *Aiton*—

Gard. Dict.		*Hort. Kewensis (2nd ed.)*
(1) *Agave tuberosa*	=	*Furcræa tuberosa.*
(2) *A. Karatto*	=	*A. americana B. foliis margine fuscis.*
(3) *A. rigida*	=	*A. lurida B. foliis angustioribus.*

* The capsule and seeds are those of **A. Wightii** *nobis*, which would seem (from *Schiede*), to occur near *Vera Cruz* in plenty.

† Not, as sometimes quoted, "*virginica*" following a mistake by **Martyn** in Vol. I. Pt. I. of the "*Gardener's and Botanists Dictionary*," London 1807.

MARTYN ON AGAVE.

With *Agave* (*virginia*) this makes seven species. *Miller's* eighth and last is *Agave* (*Vera Cruz*) which from his description is *Agave lurida H. B. C.*, or a very closely allied species.

Sherard's plant at Cambridge.

In the tenth Edition of the Gardener's Dictionary (*edited by Thomas Martyn, London, 1807*) in which there are numerous alterations, there are a few notes of interest for our present purpose, *e.g.*, that there was a large variegated **Agave** in the Cambridge Botanic Garden, which had come from *Sherard's* Eltham Garden, that had reached the age of 60 years without flowering. This was no doubt a true **Agave americana**, *Linn.* Again Mr. Cowell flowered an **Agave** in 1729 at Hoxton about which there was controversy, the owner maintaining that specimens flowered in England previously were not the "true great American Aloe," which suggests that there* was at least one other species of the **Agave—Furcraea** group then in cultivation. The third note is worth extracting,

Possibly two Agaves were then in England.

Hedges in S. Europe.

"*There are now hedges of the common Agave in Spain, Portugal, Sicily, and Calabria; it flourishes also about Naples, between Villafranca and Monaco and in other parts of Italy.*" But the common **Agave** of the Mediterranean is the *lurida* of the Calcutta Garden.

WHAT IS W. INDIAN SO-CALLED A. AMERICANA.

We have seen that *Linnaeus*, for the sake of brevity perhaps, omitted the Jamaica habitat for his **Agave americana** from the Species Plantarum, while *Sir Hans Sloane* has given what should be the same plant as a native of stony barren hills in that island, stating that the local name is *Curaca*.

Dr. Patrick Browne in his "*History of Jamaica*" (*London, 1789*) states that an **Agave** is indigenous and common in Jamaica, the name is *Corato* or *Curaça*. He gives several synonyms, of which one is the Linnæan description of "*A. vivipara*," with the specific designation omitted, but no weight can be attached to these citations because *Bauhin's* species, which is the **A. americana** of *Linnaeus*, is included, to say nothing of the *Aloe sobolifera* of *Hermann*. *Grisebach* (*Flora of Br. W. Indian Islands, London, 1864, p. 582*) quotes *Browne* for the occurrence of **Agave americana** *Linn.* in Jamaica. He also notes that he has seen specimens from Antigua and (naturalized) from S. Europe, and the E. Indies. As it happens, **Agave americana** *Linn.*, is *not* naturalized anywhere in the

* In the "*Figures of Plants*" (*London, 1760, Vol. II. p. 148, Plate CCXXII*) which were designed to illustrate the earlier editions of the "Dictionary," *Miller* has given an **Agave** that flowered at the Chelsea Garden during 1757. *Martyn* says this was a mere variety of *A. americana* which does not seem likely, but we have not been able so far to refer it clearly to any of the species described by *Miller* himself or by any other author. This illustration is the only one cited by *Ruiz and Pavon* for the Peruvian plant which they have identified with *A. americana, Linn.*, but they admit that there were certain discrepancies.

East Indies: *Grisebach* no doubt had seen Herbarium specimens labelled "*A. americana*," but belonging to another species. He observes that no other **Agave** occurs in West Indian collections, but refers to the *A. Antillarum* of *Descourtilz* comparing it with **A. sobolifera** of *Salm-Dyck*, which that author understood to have come from Haiti and Jamaica.

W. INDIAN SO-CALLED A. AMERICANA.

A. sobolifera of *Hermann* seems to be a well-marked species; it is figured* by *Lamarck* (*Encyc. Methodique, Pl. 235, fig. 1*) as *A. vivipara, L.*; '*A. americana, Rumph.*,' is quoted as a synonym, and *Commelin* (*Praeludia*) is also cited. *Lamarck's* plant is said to occur in San Domingo (*i. e.* Haiti) and Jamaica. It seems likely that the account of *Browne* relates, in part at least, to a **Furcræa**, and that this led authors to refer to the *Agave vivipara* of the Species Plantarum, which had stamens not exceeding the corolla. On the other hand both *Browne* and *Descourtilz* lay stress on the conspicuous yellow colour of the blossoms, and it is quite possible that two or more species of **Euagave** are diffused in the West Indian Islands, one being *Hermann's* "*sobolifera*," which seems to be very little known, if known at all, in England.

It may be confused with a second species.

Lamarck is quoted for another book species which hardly admits of practical identification, viz., *Agave mexicana* (*Dict. I. p. 52 and Encycl. Meth. I. 241*). In either work the plant is said to be the **Maguey** of the Mexicans. *Furcraea odorata, Persoon*, and *Agave cubensis, Jacq.*, are given as synonyms which are = **Furcræa cubensis**, *Vent.* The *Encyc. Meth.* gives no description, and that in the *Dict.* plainly indicates **Furcræa**, so that *Agave mexicana* falls to the ground as a species. His *Agave americana* is evidently = *A. lurida H. B. C.*, as he says it was naturalized in S. Europe, and he had seen living specimens.

Lamarck's A. mexicana is no species.

His A. americana is the A. lurida of India.

In *Roemer's Collectanea* (*Zurich, 1809, p. 138, Tab. I.*) *Zuccagni* figured and described an **Agave**, which he identified with the *Theometel* of *Hernandez*. The description might be meant for the species figured by *Wight* in the Icones, but we hardly think, after full consideration, that they can be identical. *Roemer's* main engraving is not very good and follows possibly that

ZUCCAGNI'S A. THEOMETEL.

* The figure appears to be taken from Hermana.

DESFONTAINE'S AGAVES.

of *Commelin's* "*Aloe polygona*" (which is not cited, however), but the enlarged drawings of the flower do not match the Indian "*vivipara.*" It is not stated whence this **Agave** was brought to the Florence Botanic Garden, where it flowered, and was described in 1806 by ***Zuccagni.***

The List of **Agaves** in the *Jardin Du Roi* published at Paris by *Desfontaines* (1815) is as follows:—

* (1) *americana, L.—variegata*
(2) *lurida, Jacq. Coll.*
mexicana
angustifolia
(3) *vivipara, L.*
(4) *fœtida, L.*
(5) *Manguai*
bulbifera, Bonpland
(6) *yuccæfolia, Red. Lil.*
(7) *spicata, Dec. Cat.*

Nos. 6 and 7 are well known species of a different group from the **Euagaves,** with which alone we are so far concerned in India. No. (4) is a **Furcræa;** so most probably was No. (3).—No. (1) was evidently true **Agave americana,** *Linn. Desfontaines* must have seen the naturalized **Agave** of S. Europe and N. Africa, and as he doubted the identity of his No. 2 with the *lurida* of *Jacquin* it was very possibly = ***A. lurida, H. B. C.,*** i.e., *Aloe americana* of *Clusius.* The suggestion that it was the "*A. mexicana,*" which the bracket implies, supports this.

SUMMARY OF AGAVES KNOWN A CENTURY AGO.

In the beginning of the 19th century, therefore, it appears that the following species of **Euagave** and **Furcræa** were known to science, viz.—

Agave (Euagave)

I. **Agave americana** *Linn.*

Origin unknown, cultivated as an ornament in the gardens of Europe.

II. **Agave Vera-Cruz** *Miller*

Introduced from Mexico; probably the *Aloe americana* of *Clusius*† naturalized in S. Europe and N. Africa (= *A. lurida H. B. C.*).

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* The numbering is ours.

† Hb. H. B. C. possesses a specimen from Xeres in S. Spain, collected by E. Bourgeau (No. 468) named *A. americana* by *Cosson,* which is identical with the *A. lurida* of the Calcutta Garden. This No. of E. Bourgeau is quoted by *Nyman* (*Consp. Fl. Europ.*) for **A. americana,** Linn., which he gives as naturalized along the shore and in the islands of the Mediterranean.

The figure (28) of *A. americana* in *Baillon Hist. des Plantes, XIII,* 16, is a fair portrait of *A. lurida H. B. C.,* particularly as regards the inflorescence. The enlarged sketch of the flower is decisive.

SUMMARY OF AGAVES KNOWN A CENTURY AGO.

III. Agave Theometel *Zuccagni*,

Native country doubtful, probably the N.-W. of Central America; flowered at Florence, 1806, or earlier;

not = *A vivipara, Linn.*

nor of *Lamarck*

nor of *Schultes Syst. VII. p. 717*

nor of *Kunth Enum. V. p. 823*

nor = *A. vivipara* of *Wight Ic. 2024*

perhaps = *Theometel* of *Hernandez* (*Anton. Recch. VIII. p. 274*)

IV. *Aloe sobolifera* of *Hermann*,

Native country doubtful, perhaps the Antilles and = A. sobolifera *Salm-Dyck* (*Kunth Enum. V. 822*)

V. *A. lurida, Jacquin* (*Collect. l.c.*),

Native country unknown;

not = *A. lurida, Ait.*

nor = *A. lurida, Gawler* (*Bot. Mag.—1522*)

nor = *A. lurida, Baker in Saunders' Refugium* (*V. 307*)

nor = *Aloe americana, Clusius*

nor = *A. lurida H.B.C.*

VI. *A.* (*species*) (sub "*Sempervivum maius.*") *Rumph. Herb. Amb.* (*ed. Burmann, p. 273 t. 94*)

Native country unknown, introduced before 17th century to Amboyna; probably = *Naeldendraet* of Dutch settlers in Moluccas mentioned by Boerhaave;—

not = *Aloe americana* of *Clusius*

nor = *A. americana, Linn.*

nor = *A. vivipara, Linn.*

nor = *A. vivipara, Lam.*

nor = *A. vivipara, Wight*

but = *A. Cantala. *Roxb.*

* *Pr. V. Salm-Dyck*, who appears to have suggested that Rumph's plant was a Bromeliacea, had probably never seen A. Cantala *Roxb.*

SUMMARY OF AGAVES KNOWN A CENTURY AGO.

VII. *Aloe Yuccæ foliis* of *Sloane, Cat. p. 118* in part
= *Heneguen* of *Oviedo*
= *Pati seu Metl lenissimum* of *Hernandez* (*Ant. Recch. p. 275*)
Native country unknown, cultivated and naturalized in the Caribean region ;—perhaps = **A. sisalana,** *Perrine.*

VIII. *Quetzalychitl quem alii Metl Pitae vocant. (Hernandez l.c.)*
Native country unknown, cultivated in Central America. If this was a **Euagave** it is possibly = our **A. Wightii.**

*IX. **A. Keratto** *Miller* (not of *Salm-Dyck*).
Native or naturalized in the island of St. Christopher.

(We have excluded from this list of **Agaves** all forms that we refer to **Furcræa** as also a few the identity of which is at present hopelessly involved and doubtful.)

Furcræa

1. **F. gigantea** *Vent.*
Native country unknown ; cult. and naturalized from Central America and the Caribean region to Northern Brazil.

2 **F. Commelynii** *Salm-Dyck*
= *Aloe americana tuberosa minor* of *Comm. Hort. Amst. 2 f. 19 (f. Salm-Dyck) (v. Kunth. Enum. v. 842).*
Native country doubtful.

3. **F. tuberosa,** *Ait.*
= *Agave tuberosa, Mill.* (*excl. A. Commelynii f. Salm-Dyck*) native or cultivated and naturalized (?) in West Indian Islands.

4. **F. cubensis,** *Vent.*
= *Agave cubensis Jacq.* (also *Willd.*)
= *Agave mexicana, Lam.*
Native country unknown ;—naturalized in the Caribean region and introduced in S. America.

It thus appears that with scanty exceptions the original home of these forms of **Agaveæ** is not satisfactorily established,

* *Agave rigida,* Miller is excluded, as its identity is altogether doubtful.

HOMES OF THESE AGAVES.

while at least three kinds (all of **Agave**) that had been described by præ-Linnean authors remain unidentified. The localities mentioned in the old books give no certain clue, because the writers did not distinguish between native species and those naturalized or even between wild and cultivated forms.

Agave americana is believed by *Martius* (*Fl. Brasil III. P. I. p. 187*) to be a native of high mountains in Mexico, but his authority is not given, and the plant was probably a different one. **Furcræa tuberosa** *Ait.*, is reported by *Seemann* from the slopes of Chiriqui, a volcano on the borders of Panama and Costa Rica. (*Hemsley Biolog. Central Amer.* l.c. app. p. 273.) A statement by another traveller is quoted for the occurrence of *Agave americana* wild in the same belt on Chiriqui at 4,000—8,000 feet above sea level, but *Mr. Hemsley* thinks that the **Furcræa** may have been mistaken for it. We think there can be little doubt of this, and further that the **Maguey cimarron** (*i.e.* wild maguey) seen by *Schiede* and *Deppe* in the "regio frigida" of Mexico Proper, whatever it may have been, was not true **A. americana** (*Linnæa IV. 581*). The very circumstance that the Mexicans distinguish the mountain sort as wild shows they are well aware that "*die allbekannte A. americana*," as *Dr. Schiede* styles the **Pulque Agave**, is unknown except in cultivation.

Pulque Agave only in cultivation.

LITERATURE ON AGAVE IN INDIA.

The first account we can trace of any **Agave** in India Proper is in a series of papers by *Dr. W. Roxburgh* which exists in two forms; one of these pamphlets was printed officially, the other appears in the XXII. Vol. of the transactions of the Society of Arts of London 1804 (which voted its thanks to the author), under the title "*Observations on the culture properties and comparative strength of Hemp, Sun, Jute, and other vegetable fibres the growth of India.*"

Roxburgh.

In a comparative statement appended with the "*Observations*" we find '*Agave americana*" given as No. 11 of the staples on which *Roxburgh* had conducted experiments.

In the official correspondence the same plant is described as a new *Agave;* in both it is referred to as found wild in plenty, though where is not stated, and there can be no doubt that the species is that afterwards described in the *Flora Indica* (*Ed. C. B. Clarke p. 296*) as **A. cantula**.

LITERATURE ON AGAVE IN INDIA.

In the *Hortus Bengalensis* (*Serampore, 1814*) three **Agaves** are shown as cultivated in the *Calcutta* (*Sibpur*) Botanic Garden, viz. :—

(1) *A.* Cantala R.* (2) *A. lurida* (3) *A. tuberosa*

Roxburgh gives origin of three species.

No. (1) is noted as introduced before 1794 from India, and as having a Sanscrit name which would now-a-days be transcribed as "*Kantala*" No. (2) is said to be a native of America, (date of introduction not given). A footnote states that No. (3) had been received from Kew, but that the species was then already in the Garden (from America 1799) under the name of "*Yucca superba.*"

Voigt takes up wrong names for one.

In the *Hortus Suburbanus Calcuttensis* (*Bishop's College, 1845*) there is no *Agave Cantala*, but a *Fourcroya Cantula* of *Haworth* appears as synonymous with the "*Agave Cantula*" of the *Flora Indica.* The Bengali name is given as "*Bilati Ananas*" and the source, doubtfully, as the Moluccas or S. China. *Graham* (*Cat. Bombay Plants., p. 272*) is cited, also *Rumpf* (*l.c.*) the usual error being admitted as to *Rumpf* having called his plant "*Aloe americana.*"

What *Rumpf* said was that the Amboyna "*Aloe*" was a very different vegetable from the true *Aloe* or "*Sempervivum*" (Lidah Boaya) and was manifestly *akin* to *Clusius' Aloe americana*, the differences being due perhaps to soil and climate.

We have not seen the original** work of *Haworth*, but his transfer of *Roxburgh's* "*Cantula*" to *Furcraea* was pretty surely an error. *Voigt* (*Hort. Suburb l.c.*) further gives "*Fourcroya tuberosa*" (no doubt the "*Yucca superba*)" and two **Agaves**, viz., 1. *lurida Ait.* 2. *Vera Crucis Haw.* He says expressly that his "*lurida*" is that of the *Hortus Bengalensis.* The first edition of *Aiton's Hortus Kewensis* issued in 1789, so that it is possible that *Roxburgh's* "*A. lurida*" was named with reference to that work, but it does not follow that the Calcutta plant and that of Kew (which appears to be extinct) were identical.

He has two others—one A. lurida as above, the other A. Vera-Crucis introduced 1836.

As regards the *A. Vera Crucis Haw.* of *Voigt*, there is happily a clear record. A note by *Wallich* in the unpublished records of the Sibpur Herbariun shews that this was introduced

* The name as spelt in the Hortus Bengalensis has priority and the species is therefore **A. Cantala**, Roxb., not *A. Cantula*, as in the Flora Indica.

** Since seen : the emennation was gratuitous ; Roxburgh's plant is a true Agave.

LITERATURE ON AGAVE IN INDIA.

Was Roxburgh's lurida different from Vera-Cruz?

from the Chelsea Garden by *Lord Auckland* during 1836, and was looked on by *Wallich* as doubtfully distinct from the existing "*lurida*." There can be little question that the plant *Haworth* meant was *Miller's* "*Vera Cruz*" *Agave*, and this presumbly is the *Vera Cruz* variety of the *Hortus Cliffortianus* also; that it is the present "*lurida*" of the Calcutta Garden we consider certain. What the "*lurida*" of *Roxburgh's* day may have been remains to be seen, if indeed we are to think that it was distinct from the "*Vera Crucis*" of the *Hortus Suburbanus*, but it certainly was not "*Cantala*." *Roxburgh's* "*Cantala*" seems to have been lost between 1840 and 1847, at which period extensive alterations were in progress. There is a Catalogue of 1847 (which is however probably not exhaustive), in which no **Furcræas** are shewn, and only two **Agaves**, viz., *A. americana Linn.* and *Vera Crucis Haworth.* The "*americana*," if it was the true *americana* of *Linnaeus*, must have been a recent introduction, because this is included in *Voigt's* list of garden desiderata.

The next after *Roxburgh* to observe an **Agave** naturalized in India was *Dr. Francis Buchanan* (afterwards *Hamilton*).

The following is from the "*Journey*" (*London 1807, p. 36*) [march of 6th May 1800, Baydamangulum to Tayculum.]

Buchanan Hamilton found planting of an Agave going on in Mysore.

"*The natives here plant also many aloes* (*Agave vivipara*) *in their hedges and use the leaves for making cordage. It forms a strong defence against both man and beast, and thrives better in the arid soil of Mysore than in any other place that I have seen;—its Canarese or Karnataca name is Ravana Meshid.*"

There is nothing to shew why *Buchanan* named his plant (which is pretty certainly the same as *Wight's*) *Agave vivipara*, but most likely he was led by *Linnaeus'* citations in the *Species Plantarum*.

Moon had 3 species in Ceylon.

Moon's Catalogue (*Colombo, 1824, p. 25*) gives as growing in Ceylon *Agave americana, A. lurida,* and *Furcræa tuberosa*. No authorities are cited, but as the English name of "*lurida*" is given as "*Vera Cruz*" (Aloe) the species doubtless was = *A. lurida H. B. C.* What Moon's *A. americana* may have been, we cannot say, and the same applies to records from the Mascarene Islands, from the Cape of Good Hope, and Saint Helena also. A St. Helena plant cultivated in the Botanic Garden at Buitenzorg (Java) has been described as a distinct species by *Haworth* under the name of *A. angustifolia*.

Naturalisation in Africa.

In the Flora Capensis (*Stuttgardt, 1823*) *Thunberg* mentions "*Agave americana*" as naturalized on Table Mountain, etc.

Certain *Agaveæ* have been long naturalized in the Mauritius. *Mr. Baker* (Flora of Mauritius, 1877) shews *Agave americana* and *Furcraea gigantea* as established. A *Furcraea* known as "*Mauritius Hemp*" is grown in parts of Southern India.

LITERATURE ON AGAVE IN INDIA.

Graham found one species at Bombay.

In his *Catalogue of the plants of Bombay and its vicinity, Graham* has the following:—"*1572 A. Cantula Roxb. Flora "Ind. 2 p. 167. Aloe americana Rumph. Hort. Amb. 5. t. 94.* "A *stately Aloe-looking plant, the central scape rising to the height "of 15 to 20 ft., flowers in rains; in gardens, Bombay, Seroor.* "*There is a variety with long flexuous leaves. The seeds germinate* "*in the capsules before they drop off, as in A. vivipara.*"

The common **Agave** of to-day in hedges near Bombay and Poona is a plant which we identify with *Rumpf's* figure and with *Roxburgh's* "**Cantala.**" It seems doubtful if there are specimens of this from the New World in European collections, unless it be *Agave laxa* of *Zuccarini* (for which see *Baker* in *Gard. Chronicle Vol. VIII. 1877. p. 780, figure 151.*). *Mr. Baker's* figure is not unlike a form that is common in hedges at Saharanpur (in the Agra Province). This form was referred by the late *Mr. Gollan* to an **Agave** that is identical with specimens recently collected in the Bombay neighbourhood, which we refer to **A. Cantala.**

Species at Saharanpur in 1855.

The Saharanpur Catalogue of 1855 shews the following,—*A. procumbens, A. tuberosa, A. cantula, A. americana, and Littaea geminiflora.* The last named is an **Agave** of a different section from the **Euagaves**, and for our purpose negligible. The "*A. tuberosa*" was probably a **Furcræa** which is still represented in the Garden, though not naturalized anywhere in N. India. "*A. americana*" probably covered **A. americana**, *Linn.* (cultivated in the Garden solely) as well as a quite different species which has run wild in waste places and hedges through the whole Civil Station. On what authority we have not been able to discover, the second species has been called "*A. lurida*" at Saharanpur for some time past. To this Saharanpur "*lurida*" (which is *not=lurida H. B. C.*) the natives give the name of "*Rámbanskeora*" to distinguish it from the ordinary "*Banskeora*" which at Saharanpur is usually applied to Wight's *A. vivipara.*

In *Dr. Jameson's* Catalogue "*Banskeora*" is appropriated to his "*Agave procumbens,*" but this is possibly a slip. If, however, the vernacular name was deliberately restricted to "*A. procumbens,*" then "*A. procumbens*" was most likely meant for Wight's "*vivipara,*" the allusion being to the way the trunk often lies along the banks of ditches and other sites where "*vivipara*" luxuriates, particularly near the old Rohilla fortifications.

If *procumbens* was=*vivipara* (Wight), then *A. cantula* must have been Roxburgh's species.

AGAVES NOW AT SAHARANPUR.

The *Agaves* now existing in a naturalized condition in and about the Saharanpur Garden are as follows,—

(*i*) ***A. vivipara*** (*Wight*)

(*ii*) ***A. Cantala*** (*Roxb.*)

(*iii*) *A.* not named; (believed by Mr. Gollan to be merely a form of the preceding) may we think be the same as *Graham's* "flexuous" variety of **A. Cantala.** It seems to have everywhere a poor reputation as a fibre plant, which is not the case with **A. Cantala** proper. This unnamed form has a weedy habit, the outer leaves often bending over almost from their point of origin.

(*iv*) "*A. lurida*" (Saharanpur).

A. Cantala is said to be widely spread in the Dehra Dun, and to extend to the outer* Himalaya, where it is used for hedges, but further enquiry is called for as to this, because it has not been always distinguished from another **Euagave** of which the Calcutta Garden possesses specimens, descended mostly from seed sent by *Mr. J. S. Gamble, F. R. S.*, from the Dehra Dun some years ago under the name of "*A. mexicana.*" Fibre was manufactured in the Dehra Jail formerly from a naturalized **Agave** described in accordance with the ordinary practice as "*Agave americana.*" It is doubtful if fibre has been ever made, save as an experiment, from the true **A. americana** of *Linnaeus,* which does not exist in the Dehra Dun, or anywhere else in India for that matter, so far as we know, in sufficient quantity.

DIVIDED OPINIONS.

The difficulties that confront the student in dealing with the **Agaveæ** are well illustrated by the case of *Roxburgh's* species. *Mr. Baker* (*Gard. Chron. 1877, Vol. VIII. p. 780*) refers *A. Cantula* of *Roxburgh* to *A. vivipara* of *Linnaeus* "*at any rate as regards the synonym Rumph. Amb. Vol. V. p. 273. tab. 94*" and at the same time cites the *A. vivipara* of *Wight* as another synonym. His view has been followed, as the best authority then available, in *Kew Bulletin No. 39, March 1890, CXXXV* **(Bombay Aloe Fibre).** He further identifies *A. Cantula* with *A. Rumphii, Hassk.* (*Cult. Hort. Bogor.*) which purports to be the plant figured in the *Herbarium Amboinense. Rumpf's* plate has often been taken for the plant figured by *Wight,* but on due examination of live specimens the

The possibility of A. Cantala being A. Rumpfii of Java.

* To about 6,000 ft. above sea level in the station of Mussooree.

COMMENTS ON A. CANTALA.

resemblance vanishes. *Hasskarl* published his species in a supplement to "*Flora*" (*II. 1842. p. 5*) as follows:—

"*Agave Rumphii mihi. Acaulis foliis lineari-lanceolatis, canaliculatis acuminatis spinis marginalibus nigris rigidis sursum arcuatis, scapo ramoso dein viviparo, staminibus corollam longe superantibus. Corollæ limbo revoluto. Ch. Sprg. S. V. II. 79— Willd. Sp. Pl. II. 195. Schlt. VII. 127. Rumph. Amb. v. 273. t. 94 Nom. Sund. Nannas sabrang=Bromelia transmarina.*"

Zollinger wrongly called the Javan plant A. Cantala.

He does not cite **A. Cantula** *Roxb.* as a synonym, and the revolute segments of the perianth of his description do not suit any species as yet observed in India. *Zollinger* (*Syst. Verz. der in Ind., Archipel, etc., Zurich, 1854*) sets aside *Hasskarl's* name in favour of *Roxburgh's;* he had at least one specimen before him and had seen the plant of *Hasskarl* living in the Buitenzorg Garden. In the latest Catalogue of that garden (*Teysmann and Binnendijk, Cat. Pl. H. B. Bogor, 1866*) *A. Cantula Roxb.,* is maintained and *A. Rumphii, Hasskarl* excluded.

In the Garden of *Sir Thomas Hanbury* at Mentone (*Syst. Cat. by G. Cronemeyer, Erfurt, 1889*) *Agave Rumphii, A. Cantula, A. vivipara,* and *A. Theometel* are all separately represented. *Mr. Watson* of the Kew Garden visited the Riviera during 1899 (*Kew Bulletin No. 36, Dec. 1889, CXXVI*) and his notes on **Agaves** include the following.

"*A. Rumphii Hassk.—Mr. Baker refers this to 'A. vivipara' but the plant under the former name in Mr. Hanbury's Garden looks like a gigantic A. rigida; it is a very fine* **Agave**, *the leaves about 5 feet long and very numerous.*"

* * * * *

"*A. vivipara Linn.* (*A. Cantula*). *A distinct species, more resembling a Furcraea. This lately flowered at Mentone.*"

Baker says A. Cantula of Riviera is form of A. rigida; if so, then Cantula of Riviera is not Cantala of India.

In November 1891 *Mr. Baker* himself visited the Riviera (*Kew Bull. No. 61, January 1892, CCXXIII*).

We extract the following as it is material:—

"*A. rigida Miller. This, the most valuable and most variable of all the Agaves, is common and quite at home in the Riviera Gardens, flowering freely; and I had an opportunity of studying its characters and range of variation far better than I had ever done before and of seeing several forms with which I was not previously acquainted. The commonest forms in the Riviera show the characteristic small distant nearly black teeth, and agree very well with*

COMMENTS ON A. CANTULA.

what has been described and figured as Ixtli and ixtlioides (Bot. Mag. t. 5893). In Dr. Hern's garden, situated just on the French side of the Boundary Gorge at St. Louis, I saw a form with leaves much thicker than usual (1½ inches thick at the base) and forming a less dense rosette. The plants called Cantula and Rumphii in the Riviera gardens are forms of rigida. Mr. Hanbury has just flowered a spineless form that agrees very well with the sisalana of Yucatan and Florida. I am quite satisfied now that A. Houllettii, Jacobi, is nothing more than undeveloped sisalana, and the same holds good with a plant called laevis. One panicle of this species at La Mortola was producing copious bulbillæ. The peduncle, including the rhomboid panicle, does not reach a greater height than 12—15 feet. The bract leaves, like those of americana, are small and distinct as compared with those of atrovirens."

If this decision be accepted it is certain that the plants named "*Cantula*," and "*Rumphii*" at La Mortola cannot be the plants of *Roxburgh* and *Hasskarl* respectively. We possess in India specimens received from Kew as "*Agave rigida*" which differ absolutely from any species naturalized in the East Indies, and from *Rumphius'* figure also. The reference to the picture and account of *A. ixtlioides* in *Bot. Mag. 5893* complicates the question, for the plant there depicted,—after every allowance for the effects of artificial nurture,—could not pass as conspecific with the **Sisal Hemp** of India. That the Indian **Sisal** is the plant introduced from Yucatan to Florida by *Dr. Perrine,* is certain; see among other authorities *Kew Bulletin No. 62 of 1892, CCXXVII* (**Sisal Hemp**) and *Bulletin No. 5, 1899, Dept. of Land Records and Agriculture, Bengal,* (**Agave sisalana**).

A. sisalana in India varies as regards its leaves from margins absolutely smooth to fairly thorny, but there is one **Sisal Hemp** in this country and one only. Leaves with and without prickles may be found on the same individual.

Royle and Wight had never seen **A. Cantala.**

To return to **A. Cantala,**—*Royle* had evidently never seen an authentic example of this (1853), nor had *Wight,* who does not even mention *Roxburgh's* species. *Wight* (*Icones VI.* pp. 18-19) says—(under *Agave vivipara*).

"*The Agave americana or as it is usually called American Aloe, now so common all over the country, belongs to the same genus and, as the name imports, comes from the same country. They are not Aloes. Rumphius has introduced a figure of this plant into his*

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Herb. Amboynensis apparently on the supposition of its being indigenous in that island."

It is needless to comment on this passage in detail, but it is essential to observe that the plant with which "*Agave americana*" is being compared is the *Agave vivipera* (*sic*) of Linnaeus, and that it is for introducing a figure of Wight's own *Agave vivipara* that *Rumpf* is (unjustly as it happens) indited. The passage seems to have been often read as if the plant of which *Burmann* added (from *Rumphius*' "*Auctuarium*)" a plate to the original account of "*Sempervivum*," was '*Agave americana*.' Actually it is neither *A.* '*americana*' nor '*A. vivipara*' (of *Wight*) but **A. Cantala** Roxb.

Burmann added plate of A. Cantala to Rumpf's work for A. americana and Wight took it to be his A. vivipara which he thought also to be Linné's.

Wight's illustration is not very good, but it cannot fail to be recognized by any one who is conversant with the Indian **Agaves,** and it should be equally impossible to confound either the species itself or *Wight's* artist's drawing with the plate in *Rumphius.* There is an unpublished drawing in the Herbarium H. B. C. marked as *A. vivipara, L.* in Wallich's handwriting under which is written "? *A. Cantula, Roxb.*" The species is unmistakably that of *Wight's* figure, the more so that both represent plants which have blossomed, when the appearance of the "rosette" or bunch of leaves (which in "*vivipara*" is highly characteristic) differs conspicuously from the previous condition.

Wight's drawing of his A. vivipara was doubtfully named Cantala by Wallich.

Wallich's query was due probably to the original "**Cantala**" having been lost from the garden; and it must, we think, be answered in the negative.

In the first place, there is a plant which is fairly abundant and self-propagated in some parts of India answering to the figure and description in the *Herb. Amb.* which *Roxburgh* after mature consideration cited for his *Agave Cantula.*

Type of A. Cantala lost but reasons for identifying species.

In the second place, the Calcutta garden name for *Wight's* species is "*A. Cantula* var. *vivipara*," which suggests that the Roxburghian plant was readily distinguishable.

The plant which we identify with **A. Cantala** is proved by specimens to be plentiful about Bombay, and through the kindness of *Mr. I. H. Burkill, F.L.S.,* we have seen undoubted examples of this well-marked species from the Northern Circars, the scene of *Roxburgh's* own chief explorations.

Roughly speaking, **A. Cantala** extends from Central India (both E. and W. Coasts) to the N. W. Gangetic Plain and

the Sub-Siwalik tract as far as the Ravi. In the arid strip between Gwalior and Delhi it seems to be absent, but another **Agave** has found its way into this vacant corner.

AGAVE OF DELHI. Apparently A mexicana, Gamble.

From a suite of specimens which the Reporter on Economic Products to the Government of India has placed at our disposal, we think that this other Agave is identical with *Mr. Gamble's A. mexicana.*

BOMBAY AGAVES. Dalzell and Gibson's statement.

Dalzell and Gibson (*Bombay Flora, Bombay, 1861*) mention three **Agaveæ** (under **Bromeliaceæ**) as follows :—

1. *Agave Cantula.* Aloe americana, Roxb. Fl. Ind. 2. 167. *A stately Aloe-looking plant, the central scape rising to the height of 15 or 20 feet, flowers in the rains. The broad ensiform leaves give material for rope or twine.*

2. *A. vivipara, is the narrower leaved plant, leaves flexuous and drooping, which may be seen growing in waste places; and is planted in situations where its roots may retain the earth when washed down by the rains. In the Madras Presidency it is employed in this way to keep up the earth near to the parapets of bridges, a practice which might with advantage be followed on our side of India.*

3. *Furcræa fœtida, Vent. in Usteri Ann. 19—54.—A plant similar in habit to Agave Cantula, but having thinner and more flaccid leaves, and green flowers. In gardens, Bombay, rare.*"

Graham had said that Bombay vivipara is var. of Cantula.

* * * * *

There can be little doubt that the "vivipara" of the Bombay Flora is the form with weak leaves that is common in hedges at Saharanpur.

Dalzell and Gibson's Cantula hardly seems right Cantula, but right Cantala is on Bombay side.

Graham made it a variety of *A. Cantula Roxb. Dalzell and Gibson* repeat *Graham* for part of their remarks, but the "broad ensiform leaves" which they assign to *A. Cantula* are puzzling. Moreover, they seem to ignore *Wight* altogether. Possibly their *Cantula* is *Wight's vivipara.*

It is curious that *Mr. Watson* speaks of *A. Rumphii*, Hasskarl, as "*a very fine Agave, the leaves about 5 feet long and very numerous*" and as like a gigantic *A. rigida.*" We hardly think that *Wight's vivipara* would be described "as a stately Aloe" or as "a very fine Agave"; unfortunately we have no specimens or picture of the *A. Rumphii* or *A. Cantula* from La Mortola, but without attempting to decide whether *Dalzell and Gibson's A. Cantula* was the same as *Graham's*, we are convinced that what we regard as the true **Cantula** *i.e.* the **A. Cantala** of the *Hort. Bengal*, is a common hedge-plant in the Bombay neighbourhood.

BOMBAY AGAVES.

In the Kew Bulletin No. 39, March 1890 CXXXI (**Bombay Aloe Fibre**) the source of this was taken to be *A. vivipara* as described by *Baker* in the Gardener's Chronicle (l.c.) which he had further identified with *Roxburgh's A. Cantula.*

The Bombay Aloe Fibre shipped in 1890 was of mixed origin.

It is impossible that this "Bombay Aloe" could be *Wight's* plant, because it had leaves 4—5 feet long and rather concave, whereas the leaves of *Wight's vivipara* are conspicuously flat on the upper surface, and the largest leaves observed have not exceeded three feet in length,—the average being two feet and a quarter.

Now it is largely from A. Cantala.

It is clear from the correspondence printed with the Bulletin just quoted that the "**Bombay Aloe Fibre**" then being shipped to England was not grown at Bombay, but obtained (from more than one species most likely) in the Carnatic and Central India. Fibre is now shipped from Bombay that is raised in the immediate neighbourhood, and, so far as our information goes, this is largely taken from **A. Cantala** of *Roxb.* (=*A. vivipara L. according to Baker as above*, not in Gard. Chron.)

Roxburgh probably experimented with fibre of A. Cantala.

Reference to the "*Observations*" quoted above will show that *Roxburgh's* experiments gave a high place among the fibres tested to the **Agave** there mentioned, which we believe to have been the same that he published later as **A. Cantala.**

Further enquiry is very necessary to ascertain whether the weak "flexuous" variety of *Graham* is or is not distinct from **A. Cantala.** Its fibre,—rightly or wrongly,—seems to be generally looked on as worthless.

It may here be noted that in *Drury's Useful Plants of India* (*Madras 1858*) Wight's Icon 2024 is quoted for "*Agave americana*" although "*A vivipara L.*" is given on the next page without comment. Of *A. americana* it is stated:—

"It is much valued as a hedge-plant, but its chief importance arises from the "excellent fibres which it yelds. Not only are these produced from the leaves, "but a ligneous fibre is contained in the root familiarly known as the *Pita* thread. "This is much used in the Madras Presidency."

We have not been able to confirm the extraction* of fibre from the root of any **Agave**, and as the passage goes on to describe the process of making thread from the leaves, there is probably a clerical error somewhere.

This "ligneous fibre" reappears in Babu T. N. Mukerji's *Descriptive Catalogue of Indian Produce contributed to the Amsterdam Exhibition*, 1883, but it is there stated to be got from the "stem" (? scape) of "*Agave americana.*"

* *Hernandez* speaks of ropes being made with the roots [themselves, which is a different matter.

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AGAVE WIGHTII.

We have so far tried to extricate the two species that are most widely spread in India, with the result that for the plant of *Roxburgh* the name given in the Hortus Bengalensis remains unaffected (species **E** of List = **A. Cantala** *Roxb.*).

A new name necessary to distinguish Wight's vivipara from the true vivipara.

For *Wight's* "*vivipara*" we conclude that a new name must be proposed, and have shown this in our List as Species **J** = "**A. Wightii**" accordingly.

Reasons have at the same time been adduced for holding that the **Sisal Hemp** (of India) has nothing to do with the plant usually styled *Agave rigida* in gardens.

CALCUTTA A. LURIDA MUST BE CALLED A. VERA-CRUZ.

We may now take up the species known in the Calcutta Garden as "*A. lurida.*" This is not the "*A. lurida*" of *Jacquin,* nor is it the plant portrayed at No. 1522 of *Sims' Bot. Magazine* and described as *A. lurida* of the *Hort. Kewensis* by *Gawler.* The leaves of that, as well as those of the *A. lurida* of *Baker* (*in Saunders' Refugium T. 307*) are on far too small a scale for the Calcutta "*lurida,*" while the habit of the latter is quite different; on the other hand, except that the segments of the perianth open campanulately in the figure, the flower in the *Refugium* is similar.

The earlier figure must be given up, we think; and the description, which was made solely from the figure, goes with it.

Aiton's description might apply to several **Euagaves,** but he doubtless meant to indicate the **Agave Vera-Cruz** of *Miller,* and the only ground on which *Miller's* name could be set aside would be that it is not classical; but at all events it does not pretend to correct latinity as does "*Vera Cucis,*" which is manifestly wrong, or "*Verae Crucis,*" which is questionable. No caveat can apparently be lodged on the score of priority. We therefore venture to restore for this **Agave** *Miller's* name of **Agave Vera-Cruz,** without attempting to pronounce whether **A. atrovirens** of *Karwiński,* and certain other forms that seem very much akin to it are specifically distinct or otherwise. This is **D.** of our Descriptive List = **A. Vera-Cruz** *Miller.*

Closely allied, it would seem, to the preceding is a plant which we have not seen except from the Saharanpur Botanic Garden, where it was received from the continent of Europe

SUMMARY OF REASONS FOR NAMES.

under the name of *A. Jacquiniana* (reduced in the Index Kewensis to *A. lurida* of *Aiton.*)*

We shall have to refer to this shortly, but the present point is that the Saharanpur plant under discussion most assuredly is not *A. Jacquiniana, Hooker.* It is nearest so far as we can judge to the **A. atrovirens** of *Karwinski* (see *Rose* in *Contrib. U. S. National Herb. v. 223—225*) ? = *A. Salmiana Otto,* which is one of the chief *Pulque* plants of Mexico: *Humboldt* (quoted by *Sir W. Hooker* in his note on *A. americana* just mentioned) writes "This sturdy, harsh and fleshy-leaved plant is uninjured by the "occasional drought, frosts and excessive cold which prevail on "the lofty cordilleras of Mexico"; and it is possible that the home of the *pseudo-Jacquiniana* is in that climate, and that it is therefore able to survive the winters of N. W. India, to which **A. Vera-Cruz** appears not to be equal, in the same degree at all events.

AGAVE SPECIES C. above is not to be named, but is nearest A. Jacquiniana

We cannot follow the reduction of *A. Jacquiniana, Hooker* to *A lurida*, if by "*A. lurida*" **A. Vera-Cruz** *Miller* be intended, and it is hopeless to compare *A. lurida* of *Aiton,* as the type† has long ago been lost, while the descriptions in the systematic books are mostly fitted to **A. Vera-Cruz,** with the misleading addition of a long caudex (as a compromise perhaps with *A. Jacquiniana, Hooker*).

We have referred to this Saharanpur "*Jacquiniana*," because if aloe fibre cultivation should extend it seems not at all an unlikely sort to be tried in the colder parts of India, though it might turn out to be of more interest to the Excise than to the Agricultural Department. At present there is not material enough even for experiment (in Descriptive List **C**).

AGAVE SPECIES A.

Agave A. of the Descriptive List is in cultivation at Saharanpur, though not as a "fibre aloe." In this the marginal spines are small, fine, ruby-coloured and close-set on a hardly perceptible border of the same tint running all along the leaf

* A. *Jacquiniana* was originally proposed by *Schultes* (*Syst. VII. P. I. p. 727*) for the plant of the *Collectanea* (with regard to *Gawler's* strictures in *Bot. Mag.* 1522) in case *Jacquin's* species should turn out to be distinct from all previously described species. In 1859 an **Agave** that had come from Honduras flowered at Kew,—was identified with *Jacquin's lurida*—and published in the *Bot. Mag.* (5097) as *A. Jacquiniana;* the correct citation therefore is *A. Jacquiniana, Hooker.* This was not impossibly = A vivipara of Wight—**A. Wightii nobis.**

† *Mr. Baker* may be right in identifying the plant he described in the *Refugium* with *Aiton's lurida*, but the segments of the perianth in *Saunders'* figure, and the leaves will not do for **A. Vera Cruz** of *Miller.*

margin. A plant reported to be naturalized in Burma seems to be this, or at least very near to it. Nothing is known of the qualities of either form (if they are distinct), nor can they be properly identified, but they are allied possibly to **Agave Keratto** of *Miller.*

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Agave Species A. not to be named, but nearest A. Keratto.

The Saharanpur specimens are named "*Agave Ixtli*," which is certainly inapplicable. The original **A. Ixtli** of *Karwinski* came from Yucatan, and his description (which is quoted in Kunth's Enum., V. p. 835) leads us to think that his plant must be near the very marked species which has been described by *Mr. Baker* in the *Kew Bulletin* (*Nos. 67, 68, July-August 1892, CCLVII,* **False Sisal of Florida**). There has been great confusion as to *A. Ixtli*, as will be perceived on reference to *Bot. Mag. 5893*, where an *Agave ixtly* of *Haworth* is mentioned as distinct from that of *Koch*,* besides *Jacobi's*, which was possibly intended to be the **A. Ixtli** of *Karwinski.*

The name A. Ixtli is not applicable.

In the notice just quoted it is suggested that *A. ixtly Jacobi* may belong to the same species with that writer's *A. fourcroydes* and *A. ixtlioides*, of which *5893 Bot. Mag.* is a representation.

In the *Index Kewensis* the "*ixtly*" (*i*) of *Koch* (*ii*) of *Haworth*, and (*iii*) of *Jacobi* are not separately mentioned, while **A. ixtli** of *Karwinski*, is reduced, with "*fourcroydes*," "*ixtlioides*," and **A. sisalana**, *Perrine* to the] *A. rigida* of *Miller.*

These identifications rest on the conclusions of *Engelmann* (*Notes on Agave reprinted in Bot. Works, Cambridge, Mass. p. 312, 1887*). His account is too long for quotation as a whole, but an extract will be given under the next species. He identifies an **Agave** that flowered at Antibes in 1872 with **A. Ixtli** (presumably of *Karwinski*), and this again with a wild **Agave** of Yucatan, called by the Indians *Chelem*. Of the '*Chelem*' he says '*which I refer with little doubt to Miller's old A. rigida.*'

He gives no grounds for this last identification, while his description has not much in common with *Karwinski's* of **A. Ixtli**, and differs in material respects from that of *Miller's A. rigida*: other difficulties apart, an insuperable bar presents

* From the notice of *Koch's* Monograph in *Bull. Soc. Bot. de France vii Rev. Bibl. 189 Karwinski's A. Ixtli* only would appear to have been included and is doubtless that intended.

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Remarks on the name A. Ixtli.

itself in the fact that **A.** sisalana *Perrine* sends up suckers freely and continuously, whereas *Miller* says of his *A. rigida*,—"*This sort never puts out suckers from the root, nor have I seen any plants of this kind in flower, although there are many of them in the English Gardens some of which are of considerable age.*"

As to **A. Ixtli** *Karwinski*, and **A. decipiens** *Baker*, the peculiar apple-green of the rather narrow channelled leaves is a striking mark, as remarked by both authors, whereas *Miller's* plant was glaucous. Moreover *A. rigida* came from the *Vera Cruz* country. while **A. Ixtli** is, like **sisalana**, from the *Yucatan* peninsula, which has a Flora, as *Grisebach* has pointed out, more akin to that of the Caribean region than to that of Central Mexico. *Miller's A. rigida* resembles **sisalana** in one point it is true,—that it was spineless (though this is by no means always so with **sisalana**) but this very character divides it from **A. Ixtli**, which is well armed.

Specimens of what we believe to be *Baker's* **A. decipiens** are growing at Sibpur and Saharanpur,—also with the Agri-Hort. Society at Lahore, from which garden the Calcutta specimen is derived, the Lahore name being "*A. rigida*," and the stock received from Kew originally. The Saharanpur supply came from a Nursery in Florida labelled "*A. rigida, type*," referring doubtless to the work of *Engelmann.* These plants exactly match *Miss Mulford's* illustration (from a photograph) of *A. decipiens* (*Missouri Bot. Garden Report, Vol. 7. 1896, p 67*), and *Miss G. E. Johnson's* outline drawings (pl. 68-69), also the sketch in *U. S. A. Department of Agriculture Report No. 9 Washington 1897, p. 45, figure 9*, except that the trunk in *Mr. Dodge's* sketch is more conspicuous,—the subject having manifestly been an old and large specimen from which the outer leaves have been cut or dropped away extensively.

"*A. Ixtli*" of *Gartenflora* 1883 (p. 149) may be=*A. ixtlioides* of Bot. Mag. 5893. We cannot think that it is=**A. decipiens** *Baker*, and it is widely removed from **A. sisalana**, *Perrine.* The synonymy is very intricate.

We have discussed this agave (*A. decipiens Baker*) at some length,—partly because of its supposed resemblance to **A. sisalana**,—a resemblance which we are bound at the same time to say we are unable to discover,—and partly in the hope of

clearing up some of the mist that has fallen upon **A. Ixtli** and on *A. rigida* of *Miller.*

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There is little to guide us as to the identity of *Miller's* plant, but there is nothing to shew that it was a **Euagave,**—and it should be looked for perhaps in another section of the Genus. The description (quoted we presume) in Kunth's Enum., V. 830 of *A.* (*Littaea*) *revoluta*, Klotzsch seems not far off it: *Hernandez "Metl V angustifolia"=Nequametl* (which is *not* the *Nequametl* of *Markgraf* apparently) should probably find a place in the same neighbourhood.

Remarks on A. Ixtli.

The last species that demands attention is the **Sisal Agave,** of which, as we have already seen, there is one species and one only in India.

Remarks on Sisal Agave.

Dr. Engelmann,—after giving a formal description of the plant which he assumed to be the wild type of the "**Sisal**" that is naturalized in Florida,—proceeded to take up certain cultivated forms as follows:—

* * * * *

Engelmann has these two varieties of "A. rigida Mill."

"**Var. longifolia**: *foliis multo longioribus glaucis, aculeato-dentatis, spina terminali non decurrenti.*

"**Var.? Sisalana**: *foliis multo longioribus viridioribus margine integris seu pauci-dentatis, spina terminali non decurrenti.* **Agave Sisalana,** *Perrine*, vide infra.

"The original* plant was, according to Miller, brought from Vera-Cruz; my specimens, on which the above diagnosis is based, were collected in Yucatan by Dr. Schott. Dr. Perrine forty, and Dr. Schott ten, years ago studied in Yucatan this interesting plant,—its different forms and economical uses, and left us accounts of it, the former in Senate Doc. 300, Washington, Mar. 12. 1838; the latter in the Report of the Agricultural Department at Washington for 1869. Both agree that there is a common native species in Yucatan, called Chelem by the aboriginal inhabitants; but from time immemorial a number of varieties, all characterized by much longer leaves, and one also by the absence of marginal spines, and differing among themselves in the quantity and quality of their

* *i.e., A. rigida* Miller, on Engelmann's theory.

SUMMARY OF REASONS FOR NAMES.

Engelmann's views on sisal.

fibre, have been cultivated by the natives of Yucatan, and are a staple product of that country to this day, furnishing the well known Sisal hemp. The people know them as Jenequen (Schott) or Henequen (Perrine) and distinguish, as [317 (29)] Dr. Schott reports, the Yaxci (Yashki) as furnishing the best quality and the Sacci (Sacqui) with the largest quantity of fibre; Chucumci, larger than the last, produces coarser fibre; Babci has fine fibre, but in smaller quantity; Citamci, with small narrow leaves and poor fibre, stands probably nearest to the wild plant. Dr. Perrine mentions another variety, Istle, evidently the Ixtli of Karwinski, as furnishing a fine fibre called Pita. These plants yield a return of leaves when four or five years old, and may last 50 or 60 years under proper management; the flowering scape is cut off as soon as four feet high, when, evidently, axillary branches continue the growth of the plant; which is thus kept so long alive by being prevented from flowering.

* * * * *

"With the name of longifolia I designate the variety known as Sacci and extensively cultivated in [318 (30)] Yucatan. It is principally distinguished by its much longer spiny leaves 4—5½ feet long 3½—4 inches wide, flowers very similar to those of the wild plant, but the filaments greenish. A. fourcroides, Jacobi Ag. 107, probably belongs here, and A. elongata, Jacobi, 108, I would refer to this form if the description did not expressly mention a channelled terminal spine.

"Agave Sisalana is the name that Dr. Perrine gave to the plant known to the natives of Yucatan as Yaxci, the most valuable of the fibre producing Agaves, and which was introduced by him into South Florida some thirty-five or forty years ago, during his efforts to acclimatize commercially valuable tropical plants in that almost tropical portion of our territory, efforts which were aided by Congress by a large

grant of land, but which were destroyed, together with his own life, during the subsequent Indian wars. With this Agave, however, he has been successful, as it is now fully naturalized, and is quite abundant at Key West and the adjacent coast."

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* * * * *

Remarks on Sisal.

The assumption underlying certain of the conclusions just quoted, that the **Agaveæ** are prone to vary within rather wide limits has influenced systematists undoubtedly, but no evidence has ever been recorded to confirm it, and so far as species naturalized or cultivated in India are concerned, we should be led to just the opposite conclusion.

All that we can draw from the facts given by *Engelmann* and others is that there are certain **Agaves** in *Yucatan* to which local native names have been attached viz., (i) *Yaxci*, (ii) *Sacci*, (iii) *Babci*, (iv) *Citamci*, (v) *Chelem*.

Henequen, as *Engelmann* points out, is a general term, and so probably are "*Pita*" and "*Istle*"; "*Chucumci*" seems to be the same word as the "*chichimecae*" of *Hernandez* (l. c. p. 271) which he states expressed the Indian mode of cooking portions of the leaves for food (*cf. Martius l. c. p. 192*). Probably this also is a comprehensive term rather than the name of a particular plant.

Martius, who appears to have consulted several works that are not mentioned by *Engelmann*, states that in the language of the Maya tribes of Yucatan. "*Qui*" or "*Quil*" signifies the plant from which fibre is got as well as the fibre, and enumerates as different sorts (i) *Sac-qui* (*Sosquil*), (ii) *Yas-qui*, (iii) *Chulul-qui*, (iv) *Chelem*.

Of these the **Yas-qui** or **Yash-qui** is from the description manifestly *Engelmann's* No. (i), and is **A. sisalana.**

The best form cultivated in the district of Merida.

It would seem that the **Sacqui** ranks highest in the estimation of the natives, and this, evidently is the plant that is cultivated on a large scale in the district of which **Merida** (Sisal* is a port of Merida) is the centre, and figured at p. 24 of *Kew Bulletin No. 62 Feby. 1892* (*CCXXVII*, **Sisal Hemp**). In the same Bulletin, (p. 31) it is clearly shewn that the **Yucatan** field **Agave** is quite distinct from that which *Dr. Perrine*, who

* The busiest fibre port now is said to be Progreso.

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was many years at Campeehy, selected as the best for the Florida plantation, and that he selected wisely.

Sacqui is an Agave of Sisal type.

Martius supposed the Sacqui might be a **Furcræa**, but the sketch already mentioned and the descriptions suggest an **Agave** of the **Sisalana** type, with a stout trunk, however, and generally more the habit of a **Yucca**. The flowers have been seen at Kew, and the plant pronounced to be probably 'var. *elongata*' of (Engelmann's) *A. rigida*. We do not know on what material *Engelmann's* description of the type of "*rigida*" was founded, but he evidently meant to indicate the "wild" original of the field **Sacqui**. Pending further exploration it can hardly be regarded as established that the wild originals of either **Sacqui** or **Yash-qui** have been found or exist anywhere.

Both have evidently been in cultivation by the *Mayas* from a great antiquity, and we propose until more is known of the **Agaveæ** of Yucatan to refer to them as,—

Adopted name for Sisal.

Sacqui=**A. longifolia**, *Engelmann*

Yash-qui=* **A. sisalana**, *Perrine*

From *Martius'* history it seems possible that a third species has been cultivated in *Yucatan* and that this was **A. Ixtli** of *Karwinski. Mr. Dodge's* account of the **False Sisal** found on and near the coast of Florida makes it not unlikely that this was unintentionally introduced along with "**Sisalana**" and has meantime been described again (from Florida) as **A. decipiens** of *Baker.*

Remarks on A-decipiens.

It is condemned by the North American experts, but the qualities assigned to it would not necessarily prevent its being used in its native country; more particularly if it be the fact, that a good deal of local fibre has for many years been shipped from the Gulf of Mexico to be mixed with other staples. Although existing solely in Botanic Gardens in India we include **A. decipiens** *Baker,* in our descriptive list of Indian **Agaveæ**, as it should be known, if only to be avoided for the reasons given by the authorities at Kew and Washington.

The result of the above examination of the authorities and material available in India may be summed up as follows so far as identity of species is concerned.

* Strictly, this should be **A. sisalana**, *Perrine* (Engelmann), but the above is less cumbrous.

REVIEW OF PRECEDING SUMMARY.

* The following Euagaves are more or less completely naturalized in different parts of India, viz.,

A. unidentified; perhaps allied to **A. Keratto** *Miller*—seen from Burma only,—fibre not known;

D. **A. Vera-Cruz** *Miller.* = *A. lurida H. B. C.* (not of *Jacquin*, doubtfully of *Aiton*),—fibre not fully known;

E. **A. Cantala** *Roxb.*—fibre exported from Bombay with that of other species; often, but wrongly called '*Agave vivipara*';

F. unidentified; approaches **A. sisalana**, *Perrine* and may possibly be *Engelmann's* "*A. rigida, Miller*" or a closely allied form; there is some ground for supposing that this plant is grown as '*A. elongata*' in the West Indies;—received in H. B. C. under the name of "*A. mexicana*" which, as shewn above, is unmaintainable;—fibre wants to be reported on;

H. unidentified,—planted in Bengal and in the Ganges "Doabs"; naturalized at Saharanpur, and there (wrongly) named "*A. lurida*"; probably allied to **A. sisalana**,—fibre wants to be reported on;

J. **A. Wightii** (nobis) = A. *vivipara*, Wight (not of *Linnaeus* or of *Lamarck*),—fibre reported on as good, but shorter than **A. sisalana.**

Of the remaining species of **Agave** in the Descriptive List (Part I) **B** (**A. americana**, Linn.) and **C** are not naturalized or grown except as ornamental garden plants in India, while **G.** = **A. sisalana** is a comparatively recent introduction. It is believed, however, to be spreading in some places spontaneously.

Only one **Furcræa** has so far shown any tendency to become naturalized in India, which is usually identified with **F. gigantea, *Vent.*** We think this may be rather **F. Commelynii**, Salm-Dyck, but information as to it is very scanty.

* While this was in the press specimens have been received from the Tanjore and Tinnevelly Districts of Madras through Mr. C. A. Barber, F. L. S., Government Botanist in that Presidency, to whom we are greatly indebted for specimens, of a small-leaved **Agave** with a granulated cinnabar-coloured terminal spine; this species is said to be planted on mud walls, as a sort of coping apparently. Its characters and uses are still under enquiry.

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It is hoped that the references in the text will be found sufficient as regards the authorities mainly consulted; but the subjoined list of the more interesting or important publications bearing on the subject may be found useful, though it is far from exhaustive, and cannot profess, even from the writers' standpoint, to be complete. This does not include standard works of reference on Vegetable Physiology and Systematic Botany (from *Linnaeus* onwards) unless for some special reason, and the same applies to local floras also.

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† These authors are sometimes said to have proposed to alter the name *A. americana* to "*A. Maximiliana,*" but their actual contention seems to have been that the term *Maguey* covers several species, one of which they held to be undescribed, and for this they proposed the name *A. Maximilianea.*

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„	VI	*Mauritius Hemp* ...	*1887*
„	XXIII	*Mexican Fibre or Istle* ...	*1887*
„	CXVII	*Fibre Industry at the Bahamas*	*1889*
„	CXXVI	*Cool cultivation of Tropical and Subtropical Plants* ...	*1882*
„	CXXXV	*Bombay Aloe Fibre* ...	*1890*

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,,	CLXX	*Mexican Fibre or Istle ...*	*1890*
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,,	CCLX	*Caraguata Fibre ...*	*1892*
,,	CCLXXVIII	*Sisal Hemp Industry in Yucatan ... ...*	*1892*
,,	CCLXXX	*Bombay Aloe Fibre ...*	*1892*
,,	CCC	*Manila Aloe Fibre ...*	*1893*
,,	CCCXIX	*Fibre Investigations in the United States ...*	*1893*
,,	CCCXXXI	*Henequen Hemp in Yucatan*	*1893*
,,	CCCXXXVII	*Poling in Agave Plants ...*	*1893*
,,	CCCXXXIX	*Resources of British Honduras ... ...*	*1893*
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PART III.—GLOSSARY.

GLOSSARY.

THIS takes in a somewhat wider field than the preceding parts, because current and vernacular names of plants and their products are not regulated or defined on any system. We have aimed at including all names of this class (so far as known to us) that appear to relate directly to the species treated in Parts I and II; but besides these there are sundry names or terms which are apt to be confused with those more properly applied to Agaveæ, or to products derived from them.

In India there is much confusion with regard to *Aloes* for example; while in America different products from the

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Agaveæ and **Bromeliaceæ**—to say nought of **Palms** and **Grasses**—have been almost hopelessly mixed up together.

In such cases other names have been included, with due explanations.

Marks used in dictionaries to denote modes of orthography which do not prevail in English are not followed in the Glossary, because, for one thing, a majority of the names dealt with were spelled,—with diversified success,—by those who used or published them, phonetically.

Different renderings of Indian local names have been in most cases entered separately, on grounds of convenience; and, for somewhat similar reasons, certain names attributed to the classical languages of India and West Asia, though perhaps no longer current, have been given a place in the Glossary.

"*French*," "*English*," or "*Spanish*" names that are chiefly current abroad are referred in doubtful cases to the language understood to be actually predominant in the country concerned.

As regards "Botanical references" the authority for scientific names printed in Italics should be sought in the second column; for others the writers of these notes are primarily responsible.

The original authority for vernacular names has been cited so far as was possible, but where specimens have been inspected we have quoted the source from which the specimen was directly communicated as our authority for the local designation:—thus for certain Indian names we quote the Reporter on Economic Products to the Government of India or the Government Botanist, Madras, because, though the name may have been previously recorded, it is from specimens collected by Sir George Watt, by Mr. Barber, or by Mr. Burkill that we have been able to identify the plant said to bear a particular name in a particular locality with some approach to certainty.

For the sets of specimens received from Madras we are greatly indebted to the co-operation of the Government Botanist and the Revenue authorities.

It is hoped that the Glossary may help to clear the way both for those who may be called on to pronounce on the identity and character of Indian 'Aloe' fibres and for all who are interested in them agriculturally or commercially. Those who have made a study of any like subject will be able to

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appreciate the intricacy of confusion that besets the local and vernacular terminology, as well as the loss and inconvenience due to it.

The chief difficulty is to keep the list within manageable bounds. In his catalogue of Fibre Plants of the World, from which we have derived much help, Mr. Dodge has observed (under "*Grass fibres*")—

> "while fibrous substance is extracted from many species of *Gramineae* the family of true grasses, the term is frequently applied to fibres derived from plants that are grasses in no sense of the word, and it is therefore misleading. Examples: '*China grass*' the fibre from a tall shrub (Boehmeria); '*Sisal grass*' the fibre from a fleshy leaved Agave; and '*Silk grass*' which may mean *Bromelia* fibre, or almost anything."

We must plead guilty to having omitted "Sisal grass" and would gladly have passed over a good many more that figure in our list, as it is; but it seemed better for the present to err rather on the side of inclusion.

We have not attempted to expound any purely botanical terms. Those employed in the text of Part I should not be found very difficult, and in any case, where a reader not versed in the botany of the *Agaveae* may want a decision, his best course would be to send an inner and an outer leaf, with some flowers in spirit (if the plant is poling), also a few pods if available, to a competent botanist for identification.

The column in the Glossary of references to Parts I and II of the Bulletin is meant to assist in finding matter bearing on the botanical history of the plant or plants to which the commercial or vernacular name is believed to refer. For economic or industrial details the Dictionary of Economic Products for India, or in case of other countries works such as Spon's Encyclopædia, should be consulted. Where only the author's name appears in the second column fuller references will be found under Bibliography (Part II, p. 72 and foll.) or on the pages quoted in the sixth column.

Glossary of local and commercial terms referring to the Agaveae (also certain other fibre plants) or to their products.

Name	Authority	Language	Where used	Scientific determination
Abaca	Spon; also Kew Bull. XXXI	Filipino	Philippine Islands	Musa textilis, Née
Abecedaire	Danielli	French	France	*Agave americana*
Abacaxi	Martius	Tupi Indian	Brazil	*Ananassa sativa* Linn.
Acebar	Rumpf	Spanish	Spanish Colonies	Aloe vera, Linn.
Aceure	De Lecluse	Portuguese	Portugal	Ditto
Acibar	Ditto	Spanish	Spain	Ditto
Adam's Needle (1).	Spon; also Watt E.D.	English	Cosmopolitan	Yucca gloriosa, Linn.
Adam's Needle (2).	...	Ditto	Ditto	Agave sp.
Adam's Needle (3).	Guilfoyle	Ditto	Australia	*Yucca filamentosa*
African Hemp	...	Ditto	....	Sansevieria sp.
Agave Palo	H. B. K.*	Spanish	Central and South America (Mexico and Venezuela)	*Tillandsia recurvata* Willd.?

* Humboldt, Bonpland and Kunth.

Page	Remarks
...	The *Manilla* hemp; to be distinguished from *Manilla Aloe fibre.*
85	Probably (D)=*A. Vera Cruz*, Mill. Applied to other plants besides.
...	The cultivated Pine apple, which has yielded fibre in America, Malaya, India, &c.
79	Introduced with the plant by the Spaniards and the Hollanders to their East Indian possessions. See *Acibar.*
79	De Lecluse says that this is a corruption of the next following. Cf. *Azul Champahra.*
79	From the Arabic *Sabr* or *Sabir*, pronounced, when the definite article is prefixed, as *'As-sibar.'* Though forms of the true *Aloe*, as distinguished from the 'American aloes' (*Agaveae*), are supposed to be native in S. Europe and India, the names given to the drug (to which by some writers *'Acebar,'* &c., are restricted), and often to the plants, are from the language of the Arabs, to whom the best sort of medicinal *Aloe*, derived from *Aloe Perryi*, Baker (confined to the island of Socotra), was known from antiquity.
78	The genus *Yucca*, which is at present placed with the *Liliaceae*, should probably be united with *Agave* and certain other genera in a distinct order (Agaveæ). All the species of *Yucca* are natives of Central America, where several are known as fibre- and also soap-producers. Fibre has been got from *Yucca gloriosa*, Linn. in India, where it thrives, and is said to be naturalised in Madras and in the outer Himalaya. Spon's information that a *Yucca* is naturalised in Bengal requires confirmation.
87, 105	Said to be applied in Kangra (Panjab) to an *Agavea* (A. Cantala, Roxb. ?).
78	Introduced into Australia and reported suitable for fibre extraction.
77	Abbreviated from *'African Bowstring hemp,'* produced by different African species of *Sansevieria.*
97, 98	Different species of *Tillandsia* (belonging to the order *Bromeliaceae*) known as 'Spanish moss,' &c., yield a kind of 'tow' principally used for stuffing mattresses, &c., classed in France as 'Crin Vegetal,' (Vegetable Hair). It is not known how this particular *Tillandsia* came to bear a name simila to the scientific designation of certain 'American aloes.'

Name	Authority	Language	Where used	Scientific determination
Agave Thread	...	English	Europe and America	Agave and Furcraea sp.
Agua de Miel	Miss. Gdn. Rept. 1896	Spanish	Central America (Mexico)	Agave atrovirens, Karwinski (and other species ?)
Agua Miel	Martius	Do.	Ditto	*Agave americana*
Aguardiente	...	Do.	Spain and Spanish Colonies	...
Ditto	Rose	Do.	Central America (Mexico)	Saccharum officinarum, Linn.
Aguardiente de Maguay	Miss. Gdn. Rept. 1896	Do.	Ditto	*Agave americana*
Allaguey	Fragoso (in C. Bauhin, also Sloane)	(Not known)	C. America (? Grenada)	*Agaveae* sp.
Aloe (1)	...	English, French, German	Cosmopolitan	Aloe sp.
Aloe (2)	C. Masson (Journeys I, 104)	English	India	Nannorhops Ritchieana, H. Wendl.

Page.	Remarks
...	Applied to fibre or prepared yarn obtained from different species of *Agaveae*.
97, 98, 100, 139, 140	The sap that exudes into the basin (*cajete*) formed by cutting out the vegetative cone or 'bud' of certain *Agaves* when about to 'pole', to obtain the '*Pulque*' or native cider of Mexico. Literally 'mead', 'honey water', or 'hydromel.' Some authorities state that a spirit (*Aguardiente*, see below) is got from this liquor by a further process; also vinegar.
Do.	The true *Agave americana* of Linnæus, our (B), does not seem to be one of the '*Pulque*' kinds, but in any case what Martius had in view was a different species.
98	'Fire-water,' or Brandy.
Do.	Rose states that the spirit sold at the present day in Mexico as '*Aguardiente*' is distilled from 'Cane,' presumably from molasses (but see the next, also '*Chinguirito*').
88, 98	See '*Agua de Miel*,' '*Chinguirito*,' and the preceding.
97	(By a misprint in Danielli *Allaguey*). Fragoso identifies his *Allaguey* with the *Fil y Agulla* of S. Spain which is our (D) = *A. Vera Cruz.* Mill. Probably corrupted from the Spanish '*El Maguey*,' Cf. '*Amaguey*.'
113	The species known under this name prior to the discovery of America belong to the genus *Aloe*, Nat. Ord. *Liliaceae*. The word is probably derived in Europe through the West Asian languages from an African original. Most of the true aloes are natives of West or South Africa and the adjacent islands; but at least one species is found in S. Europe and an allied form on the coasts of India; while another form (*Aloe indica* of Royle) occurs at the base of the N.-W. Himalaya. The leaves of certain species of *Agave* resemble those of the true *Aloe*, so that when the *Agaveae* of the new World came under notice they were classed with the *Aloes*, and this reference, though recognised scientifically as an error since the time of Linnaeus, has persisted in the popular vocabulary of different countries to the present. Economically the true *Aloes* are chiefly important as the source of a drug, while the *Agaveae* ('American Aloe,' etc.) are best known as yielding fibre.
...	A dwarf palm (Palmetto) found in the Indus Valley from the Salt Range southwards, and more abundantly in parts of Afghanistan and Beluchistan, called in Pashtu '*Mazrai*',—W. Panjab '*Pattha*,' and by the Biluch '*Pesh*' *etc.* Better known under Griffith's name of '*Chamaerops Ritchieana*,' having been referred by him to the same genus as the Mediterranean *Chamaerops humilis*, Linn. Like the *Palmettos* of Florida, now placed under *Sabal* and *Serenoa*, the Oriental Palmetto yields a fibre, but its local use is chiefly for 'grass-shoes' or sandals, binding strips, and matmaking (see *Pesh* and *Wild Aloe*). The 'fish' plant elsewhere mentioned by Masson is no doubt the same.

Name	Authority	Language	Where used	Scientific determination
Aloe Americana	Danielli	Italian	Italy	*Agave americana*
Aloe Boemica	Ditto	Ditto	Do.	Ditto
Aloe Fibre (1)	Dodge	English	India	*Aloe indica*
Aloe Fibre (2)	Balfour (Cyclopædia)	Ditto	S. India	*Agave americana, A. vivipara, Furcraea gigantea, Yucca gloriosa*
Aloe Fibre (3)	Imp. Inst. Hand book (Ind. Sect.), No. 12	Ditto	Do.	*Agave americana*
Aloe Fiorentina	Bertoloni	Italian	Italy	Ditto
Aloes (1)	...	English, French, German	Cosmopolitan	**Aloe**, species
Aloes (2)	Bojer Hort. Maur. p. 353	French	Mauritius	*Agave americana* Linn. (Sprengel)
Aloes a petites feuilles	Ditto	Do.	Ditto	*Agave angustifolia, Haw.*
Aloes d' Amerique	Danielli	Do.	France	*Agave americana*

Page	Remarks
85, 86, 118-120	In a recent article in the '*Gartenwelt*' M. Al. Berger (La Mortola) has observed that two variegated kinds occur on the Riviera, one of which is *Agave picta* of Salm Dyck, and quite distinct from *A. americana*, Linn. which would seem to be naturalized to some extent in that country. It is clear, however, that the *Agave* which is most commonly spontaneous on the Mediterranean coasts is our (D) *A. Vera Cruz*, Mill., and in S. Europe this is often called '*A. mexicana*' or '*A. americana.*' In Britain it has usually been called since Aiton's time '*A. lurida,*' but is sometimes ticketed '*A americana.*'
Do.	Possibly the true *Agave americana* of Linnaeus, as distinguished from the '*A. americana*' of S. Europe, which is commonly = D (*A. Vera Cruz*, Mill.).
...	Fibre from India was shown at the Chicago Exhibition of 1893 under this name as produced from '*Aloe indica.*' Along the coasts of W. and S. India another form of *Aloe* is found (*Aloe littoralis*, Koenig) which European botanists have usually regarded as a variety of *Aloe vera*, Linn., and fibre from this plant has been at different times prepared in India.
96	By *A. americana* is intended probably *A. Cantala*, Roxb. (E), and *A. Vera Cruz*, Mill. (D); by *A. vivipara* (J) of these notes, *i.e.*, *A. Wightii*, or perhaps (E) also. *Yucca* fibre has undoubtedly been handled in Madras, but the species is not, so far, ascertained properly.
96	In 1893 Mr. Thompson reported that 'Aloe fibre' was used in his brush factory in the Nilgiris; Genl. M'Leod also reported that the fibre of the 'American aloe' had been used for brushmaking, and apparently brush fibre from *Agaveae* was readily obtainable in certain bazars. The plant intended by Genl. M'Leod seems to have been the '*Railway Aloe*' which is usually our (D), *i.e.*, *A. Vera Cruz*, Mill. (see also *Mexican fibre*).
111, 126	Probably = (D) which is *Agave Vera Cruz*, Mill.
107	The drug produced from *Aloe vera*, Linn, *Aloe Perryi*, Baker, and other species of true *Aloe*.
96	Bojer cites Andrews' Repository, but the plant which he saw naturalized was probably distinct from that which he says was grown in gardens.
88	Cf. *Anana de pite.*
118-120	'*American Aloe.*' See *Aloe americana* above.

Name	Authority	Language	Where used	Scientific determination
Aloes Pite	Aublet	French	S. America (French Guiana)	*Agave americana*
Aloes Pitta	Danielli	Ditto	S. France (Provence and Roussillon)	Agave Vera Cruz, Mill. (probably)
Aloes Pitte	Loiseleur-Deslongchamps (Flor. Gall. Ed. L. P. I. p. 289)	Ditto	France	*Agave americana*
Aloes Vert	...	Ditto	Mauritius	*Furcraea* sp.
Aloe	Visiani	Sclavonic	S. Europe (E. Adriatic littoral)	*Agave americana*
Amaguey	Edwards	Filipino	Philippines (Pangamian and Zambales)	Agave sp.
American Aloe (1)	Smith (Dict. Ec. Plants)	English	Cosmopolitan	*Agave americana*

Page.	Remarks
98	Probably a *Furcraea*.
86, 112 126	Cf. *Pita*.
86, 112, 126	Agave (D) = *A. Vera Crus*, Mill.
94, 95, 105	'*Mauritius Hemp*.' In Madras fibres have been shown which were ascribed to '*Agave viridis*,' meaning probably a species of *Furcraea* introduced from the Mauritius (see *Mauritius Hemp* and *Piet*, also *Green Aloe*).
86, 120, 126	=(D), *i.e.*, *A. Vera Cruz*, Mill.
...	Mr. Edwards states that two *Agaves* are grown in the Philippines for fibre, viz. *A. sisalana*, Perrine (our G), which he calls Henequin, and '*A. americana*'*. The second is probably not=(B), *i.e.*, the true *A. americana* of Linnaeus, and may cover more than one species, derived perhaps originally from the Pacific coast of Central America. The Agaves were first used commercially in the Philippines to supplement the stock of the true *Manilla Hemp*, which has long ceased to equal the demand; but their fibre now supports an independent industry. The word is probably corrupted from the Spanish '*El Maguey*' (see also *Manilla Aloe fibre*).
98, 99, 113	A comprehensive term for different species of *Agave*, which has spread everywhere since the introduction of *Agaves* into S. Europe where they were popularly compared with local species of *Aloe*. The *Agave americana* of Linn. is of comparatively minor economic importance, and the many references made to '*Agave americana*' as a source of fibre, beverage, &c., usually relate to some other plant, not always an *Agave* (see also *Amerikanische Aloe, Aloe Americana, etc.*).

* While this was in the press a specimen of the common naturalized Agave of the Philippines was received at Kew from Mr. Edwards and proved to be the Amboyna 'Aloe' of Rumpf, that is our (E) = Agave Cantala Roxb.

Name	Authority	Language	Where used	Scientific determination
American aloe (2)	Balfour (Cyclopædia)	English	India	*Agave americana*
Amerikanische aloe	...	German	Germany	*Agave americana*
American aloe fibre	...	English	India	.....
Amole	Dodge (also Miss Mulford, Coulter, Rose &c.)	Spanish	C. America	Agaveæ, Spp
Anai Kathalai	Government Botanist Madras	Tamil	S. India (Tinnevelly)	Agave Vera Cruz, Mill.
Anaik Katra-ghai	Mukerji Descr. Cat. Ind. Prod. Amsterdam, etc, 1883	Do.	Ditto	Ditto
Anaik Katra-zhai	Watt E D.	Do.	Ditto	Ditto
Anai Kattalai	Government Botanist Madras	Do.	S. India (S. Arcot)	Ditto

Page	Remarks
99	The true *Agave americana* is not common in India, except as an ornamental plant in gardens, &c., while the term is popularly applied to more than one species of *Agave* (as well as *Furcraea*).
84, 86	In Northern Europe this title is usually applied to the true *Agave americana* of Linne, while the *Agave americana* (or American aloe) of S. Europe is, for the most part, *A. Vera Cruz*, Mill. (our D), which does not thrive as a rule out of doors in N. Europe.
105	Used to indicate the fibres locally obtained by different processes for cordage from different species of *Agave*, *Furcraea*, and *Yucca*. We have referred the *Agaveae* known to us as yielding American aloe fibre in India commercially to— (E) = *Agave Cantala*, Roxb. (G) = *Agave sisalana*, Perrine (J) = *Agave Wightii*; also (F) (unidentified). Besides these species (H) is mentioned as suitable for experiment; (D) is doubtful.
97	Several *Agaveae* possess detergent qualities. In the West Indies certain kinds of *Euagave* (*A. Morrisii*, Baker and *A. Keratto*, Mill. possibly also *Furcraea*) are or were generally used for scouring floors, &c., and from one or more of these a soap has been manufactured which can be used with salt water. The fine toilet soap made in Illinois is from a *Yucca*; but several *Agaves* of the *Manfreda* and *Littaea* groups yield scouring material in the United States and N. W. Mexico. These are known locally as "*amole*." The rootstock of the *amole* plants is said to be the part used: it is the leaf of the Euagaves in the West Indies. 'Amolilla' (Dodge) is a *Prochnyanthes* and not known in India.
83, 85, 86, 99, 103, 126, 131, 139, 147	(D) of this bulletin. See *Anai Kattaley*, etc.
...	Variously spelled 'Anak' or 'Anaik,' and the second part with a 'g' or a 'z.' Meaning not known to us. Cf. *Anai Kattalai* and *Kadanaku*.
Do.	See the preceding.
Do.	(D) of this bulletin. See *Anai Kathalai*, etc.

Name	Authority	Language	Where used	Scientific determination
Anai Kattaley	Balfour (Cyclo-plædia)	Tamil	S. India	*Agave americana*
Anai Kuttalei	Brown and Wood	Do.	S. India (Madras)	*Agave americana* Linn.
Anak Kattalai	Government Botanist Madras	Do.	S. India (S. Arcot)	Agave Vera Cruz Mill.
Anak Kattali	Ditto	Do.	Ditto (Coimbatore)	Ditto
Anakyitha	Ditto	Malayalam	S. India (Malabar)	Ditto
Anana de pite	Bouton (in Sloane)	French	Mascarene Islands	*Aloe Yuccae foliis.*
Ananas	Watt E. D.	American native language not specified	Cosmepolitan	*Ananas sativa,* Linn.
Ananas Boaya	Rumpf	Malay	Amboyna, &c.	Agave Cantala. Roxb.
Anañas bravo	Acosta	Portuguese.	S. W. India	Pandanus sp.
Ananas Costa	Martius	Ditto	Java	*Agave Rumphii*
Ananas Manso	Do.	Ditto	Portugal, Brazil &c.	*Ananas sativa,* Linn.
Ananas utan	Rumpf	Malay	Amboyna, &c.	*Agave Cantala* Roxb.
Arbol de las Maravillas	Acosta	Spanish	Spain, &c.	*Agave sp.*
Arbol de Maguey	Do.	Ditto	Ditto	*Ditto*

Page	Remarks
83, 84, 86, 95, 99, 124, 131, 147	The proper spelling, we believe, is 'Ane kattale;' *Kattale* is presumably = Rheede's '*Catevala*' ('Kanta wala' = prickly ?); and 'Kantala' (which see):— 'Ane' or 'Anai' we understand to signify the elephant in Tamil, &c., so that the prevailing name of (D) in Madras may be taken to mean "Elephant Aloe."
95	Evidently the same as the *Anai Kattaley* of Balfour.
83, 85, 86, 99, 106, 126 131, 139, 147	Variants, no doubt of '*Ane*' (or 'Anai') *Kattale*, which appears to be applied very uniformly in the Madras Presidency to Agave (D).
86, 147	Agave (D). The first element may be = 'Ane,' and the second = Kia (Pandanus).
117	Perhaps a *Furcraea;* but the 'Anana' suggests rather a Bromeliad. See also *Pitte Ahetz*, and *Laffa*. The *Bouton* quoted by Sloane was, of an older generation, obviously, than the Editor of the Reports of the Natural History Soc. of the Mauritius.
...	Originally the pine-apple (Nat. Ord. *Bromeliaceae*); but in various parts of the world applied to sundry other plants; cf. *Nanas sabrang*, &c.; it seems to be given in Malaya to all plants whose leaves in shape and texture look like those of the pine-apple, fibre plants particularly.
88, 133 &c.	See *Nanas Boaya*.
...	See *Kyre & Mellis Cour*.
88, 133, 110	Martius thinks that this Agave, which has been identified with our (E) = *A Cantala, Roxb.* was so named because brought to Java from the Indian Coast.
...	= Cultivated pine-apple.
88, 133 &c.	See *Nanas utan* and the preceding. The Portuguese in India likened the screwpine (*Pandanus*) to the American pine-apple, which they introduced to India and Malaya and the Malays have transferred the name either from the pine-apple or the screwpine to certain *Agaveae* (see *Nanas utan*, &c.).
110	See *Maguey*.
110	Ditto.

Name	Authority	Language	Where used	Scientific determination
Area	Linschotten (in Bauhin)	Guzerati ?	Western India (Guzerat)	**Aloe sp.?**
Area	Garcia del Huerto, Aromatum etc. ed Clusius, Antwerp 1567.	Ditto	W. and Central India (Guzerat and Deccan)	*Aloe, Agave* or *Pandanus sp.*
Azul	...	Portuguese	Portugal &c.	**Aloe sp.**
Azul Champahra	Ruiz and Pavon	Spanish	Peru &c.	*Agave americana*
Bahamas Hemp	Kew Sel. Papers (Addl. Ser. II) LII	English	England and America	*Agave rigida* var.
Pakkul	Balfour (Cyclopædia)	Bengali	India (Bengal)	*Agave americana*
Balu rakkisa	Ditto	Telegu	S. India	*Agave americana*
Banada Kattala	Liotard	Telegu	S. India (Mysore)	*Agave variegata*
Banskeora (1)	O'Shaughnessy (Bengal Dispensatory, Calcutta, 1819)	Hindustani	N. India	*Agave vivipara*
Banskeora (2)	Watt E.D.	Hindustani	N. India	*Agave americana*

Page	Remarks
113	This may have been a Persian name, but seems to be used in the Malay Archipelago for a species of Pandanus. It is given here as it may still be in use locally. Unidentified fibres with a similar name have been exhibited in S. India.
.....	
113	The Arabic word for 'the sky' and so 'blue' &c. Applied apparently to some bulbous plant, possibly of the Squill family, and transferred by the Moors or the Crusaders to the aloe of S. Europe; later to the *Agave*. In Spanish "Azul" means blue, and is applied apparently to vegetable surfaces with a 'blue' or 'grey' (glaucous) tint such as the leaves of *Agave Vera Cruz*, Mill.
85	*Azul* is *Agave* as noted above, and '*Chaparra*' is 'a kind of oak'; perhaps the name (if not the *Agave* itself) came from some tract to which oaks extend on the Andes. Ruiz and Pavon say that their plant is common on cliffs in Peru, and is also found in warm valleys. The existence of any wild *Euagave* to the south of Columbia requires confirmation.
144, 146	See *Sisal Hemp*, &c.
96	Balfour meant perhaps the Bengal Presidency. No such name seems to be known for *Agave* in Lower Bengal; but it is a local term in parts of Central India for 'the fibrous bark of the roots of certain trees used' [in Malwa] * * * 'as a cheap substitute for string and cord,' (Dr. Tranter in Liotard, p. 65), and about 1852 '*Agave Cantala*' which is said to be common in Malwa was used as a substitute for the true '*Bakkul.*' The traditional '*Bakal*' is birch-bark from the Himalaya, while *Bacula* of the 'Asiatic Researches' was an epithet of several trees or herbs with fragrant flowers, *e.g.*, *Mimusops Elengi*, (Bengali 'Bokul').
105	Cf. *Rakus*, &c.
...	Probably *Agave americana*, Linn. var. *variegata*, from which fibre has been obtained experimentally. The compilers say the staple was shorter than that of 'Agave americana' fibre by which they doubtless meant (D).
91, 102 105, 121 123, 127 131, 133 137, 147	from '*Bans*'=bamboo, and '*Keora*'=screwpine: commonly applied from Behar to the E. Panjab to Agave (J)=*A. Wightii* of this Bulletin. At Saharanpur (E) and (H) are distinguished as *Rambanskeora*.
96	*Banskeora* seems pretty well restricted to (J)=*Agave Wightii*.

Name	Authority	Language	Where used	Scientific determination
Bara Kanur	Watt E. D.	Bengali	India (Bengal)	*Crinum asiaticum*, Linn. var. *toxicaria* Herb.
Bara Kanwar	Ditto	Hindustani	S. W. India	*Agave americana*
Barba De Palo	Dodge	Spanish	Central America (Venezuela) &c.	*Tillandsia usneoides*, Linn.
Barbadoes Aloes	Voigt (Hort. Sub. Calc.) etc	English	Cosmopolitan	Aloe sp.
Bas Kitri	Liotard	Hindustani	N. W. India (Rohilkand)	Agave sp.?
Bastard Aloe	Brown and Wood (also Balfour)	English	S. India	Agave Wightii (of this Bulletin)
Bastard Tequila	Rose	...	Central America (Mexico)	*Agave Sp.*
Bear grass	Dodge (and others)	English	Northern and Central America; also in Australia	Yucca Sp.

Page	Remarks
...	Cf. *Baskitri* and *Sodursun*, also the following.
96	'*Kanwar*' (Cf. *Kantala, Kenda, Catevala* and so forth) probably refers to the prickly leaves of the *Aloe* and *Agave*, but the 'Kanwar' of Central and W. India is confused with Kanwar (*Crinum*) on the one hand, and with species of *Pandanus* (*Keora, Kiakanta*, &c.) on the other. Cf. the preceding, *Baskitri* and *Sodursun* also *Kunwar*.
..	Lit. Wood- or Tree-beard. Nat. Ord. *Bromeliaceae*. Cf. *Agave Palo* above.
...	A pharmaceutical term for the drug prepared from a true *Aloe*.
...	Liotard, quoting an epitome of local reports on paper fibres in the North-Western Provinces, says that in the Lalitpur District (towards Central India) a wild fibre plant occurred called *Soodursun* which was identified with a Rohilkand plant called *Baskitri*, from which paper was made at *Moradabad* (Rohilkand). As to the 'Soodursun' see *Sodursun* below: the *Baskitri* was perhaps Agave (J), Bas (scent) having been substituted for Bans (bamboo).
91, 147	The first *Agaves* to be imported into India were, as we believe, E = *A. Cantala*, Roxb.,—and J = *A. Wightii*, ('A. vivipara' of Wight). Both probably reached India by the Pacific from the Jalisco Province (now a State) of Mexico, where a somewhat similar distinction is kept up between the '*Tequila*' and '*Bastard Tequila*'. 'Bastard Aloe' seems to be in use in S. India only, and is probably a translation from some forgotten Portuguese appellation.
	Mr. Rose identifies the '*Bastard Tequila*' (which is presumably a translation of the local Spanish) of Western Mexico with the '*Huila*' of Bolanos in the State of Jalisco, and refers the *Huila* to an *Agave*, which differs from the true 'Tequila' by being smaller. *Tequila* is the capital of the State (formerly province) of *Jalisco*, on the Pacific, where ports were maintained for trade with the Indian Seas by the Spaniards. It seems not impossible that Mr. Rose's '*A. vivipara*' may be our Agave (E) (*A. Cantala*, Roxb.) or a nearly allied species, and that the *Bastard Tequila* may be Agave (J). Cf. *Bastard Aloe*.
78	Species of *Yucca* and *Dasylirion* which yield a fibre in the Southern States of the Union and in N. Mexico are called '*Bear grass*.' None of these have been introduced so far in India, unless horticulturally.

Name	Authority	Language	Where used	Scientific determination
Bhoobtha Pharangi	Govt. Botanist Madras	Canarese	S.India (S.Canara)	Agave Cantala. Roxb.
Bhuttala	Watt E.D.	Canarese	S. India	*Agave americana*
Bilatee ananas	Roxburgh	Hindustani	India	*Agave Cantula*, Roxb. (Fl.Ind.) [A Cantala, Hort. Beng.]
Bilatte Nanas	Martius	Hindustani	India	*Agave Cantula*, Roxb.
Bilati Anannas	Voigt	Bengali	India (Calcutta)	*Fourcroya Cantula*, Haw. [Agave Cantala, Roxb.]
Bilati Pat	Watt E.D.	Do.	Ditto	*Agave americana*
Binder Twine	...	English	N. America, etc.	Agave spp.
Bitter Aloes	...	Do.	England, &c.	Aloe spp.
Bois Chandelle	Aublet	French	Mauritius	*Agave fœtida*, Linn.
Bois de Meche	Martius	Do.	Antilles	*Fourcroya cubensis*
Bois Meche	Aublet	Do.	Mauritius	*Agave fœtida*, Linn

Page	Remarks
88, 133, &c.	'Bhurt' in different Indian dialects signifies a 'thorn' or 'burr' and 'faringi' is of course = 'frankish' or 'foreign.'
105 &c.	Perhaps this is (J), = our *Agave Wightii.*
87, 100, 105,129, 133, 135 to 139, 147	'Foreign pine apple' = (E) of this Bulletin. See also *Adam's Needle* (2), *Aloe fibre* (2), *Ananas boaya, Ananas costa, Bombay aloe fibre,* &c. Roxburgh says that *Bilatee ananas* is the 'Hindoo' name, (*i.e.*, in the lingua franca of 'Hindustan') see *Bilati Anannas* (Voigt) also.
Do.	Martius appears to be quoting a paper, which we have not seen, by Blume.
Do.	A Serampore Garden name perhaps, and Roxburgh may have got it from Carey.
96	Meaning 'foreign fibre;'—Cf. *San ka Nar.*
96	Twine made from vegetable fibre used for tying sheaves at harvesting. One of the chief uses of the *Agave* fibre commercially is, or was recently, to supply the demand for Binder twine, in the U. S. A. especially. Binder *strips,* cut or torn from the raw leaf of certain species [in India (D) and (E)] are used in the N. of Madras (Burkill) and in the Philippines (Edwards) for tying bundles of tobacco (for drying?).
127	The pharmaceutical substance obtained from different species of true *Aloe.*
94, 95, 97	From the 'chandelier' inflorescence : a *Furcraea.* See the next.
94,95,97	Martius, referring to *Labat's* 'Voyage aux Isles,' notes that the *Bois de Méche* (*i.e.*, 'Tinder-or Match- tree') yielded fibre, and that the pith of the stem (flowering scape) was used for tinder and for corking phials, etc. *Agave* and *Furcraea* were perhaps best known to the early voyagers owing to the dry 'poles' furnishing a handy substitute for tinder to mariners. The name crossed from the Islands to Guiana, and travelled thence to the Mauritius. See *Bois Meche,* and *Tol, Mauritius Hemp, Piet* and *Pite,* also.
94, 95, 97	*Agave fœtida* of Linnaeus is *Furcræa gigantea* Vent.; but Aublet goes on to quote a synonym from Plukenet which is *F. tuberosa,* Ait. Both were probably known in Guiana (whence the *Pite* came to the Isle de France), but the species now grown in the Mauritius is perhaps still a third; see *Mauritius Hemp,* etc.

Name	Authority	Language	Where used	Scientific determination
Bombay Aloe	Dodge	English	England &c.	*Agave vivipara*
Bombay Aloe fibre	Kew Sel. Papers (Addl. Ser. II) LX & LXI	Do.	England	*Agave vivipara* Linn.
Bombay Hemp	D	Do.	Do.	*Ditto*
Bontha Kithanara	Govt. Botanist Madras	Telugu	S. India (Godaveri)	Agave V Cruz. Mill.
Bowstring Creeper	Dodge	English	India	*Marsdenia tenacissima*, W. and A.
Bowstring Hemp (1)	Roxburgh	Do.	Do.	*Sanseviera Zeylanica*, Willd.
Bowstring Hemp (2)	Madras Exhibition Cat. 1855	Do.	S. India (Masulipatam)	Agave sp.?
Bowstring Hemp (3)	Martius	Do.	India	*Sanseviera lanuginosa*, Willd.

Page	Remarks
138	The reference is to '*Bombay Aloe Fibre*' (which see), but the name has been given in India to several distinct species, including our (E). *A. vivipara* of Wight,=our (J) or *Agave Wightii*, is sometimes called 'the Bombay Aloe,' but yields comparatively little perhaps of the '*Bombay Aloe fibre.*'
138	When the export of '*Aloe fibre*' from India recently attracted notice in England, the chief port of export was Bombay, and the staple seems to have been known commercially as 'Bombay Aloe fibre.' Specimens of a plant supposed to yield the commercial product sent for determination were referred to *A vivipara*, Linn., a name which, for reasons given under Part II, we recommend should be dropped altogether. 'Aloe fibre' was originally shipped (from Madras ports—chiefly) about 1854—60, when the flax and hemp trades were depressed it is believed in Europe, but the export died away again. Some fifteen years ago the Indian trade revived,—through Bombay this time,—but the fibre was got mainly from Madras and Central India, and derived from various species. That now exported and largely grown near Bombay city is mainly from our *Agave* (E.), *i.e.*, *A. Cantala*, Roxb. (naturalized) and *A. sisalana*, Perrine (planted).
	See the preceding. Usually applied, however, to *Crotalaria* and *Hibiscus* fibre.
86, 147	(D) of this Bulletin. Cf. *Kithanara*, etc., also *Kalabuntha*.
...	See *Bowstring Hemp* (1) and (2).
77	Roxburgh's experiments on Indian fibres led him to give the "*Moorva*" or "*Moorgalie*" plant a high place economically; but he considered that the strongest of all was that yielded by a twiner of the same order as the *Yercum* (*Calotropis*), his '*Asclepias tenacissima*' (now referred to *Marsdenia*), called in the Rajmehal hills of Bengal '*Jetee*' or '*Jiti.*' *Sansevieria* fibre he called '*Bowstring Hemp*,' and the name has been extended to other species used in Africa, America, etc. In India *Sansevieria* is understood to be mixed with *Agave* fibre occasionally; its local names are apt to be confounded with those of *Agaveae;* see next item, also *Morva, Murga, Maurvi, Muruvu-dul, Sagenara;* etc. Cf. also *Anana de pite, Pitta Ahetz* and *Laffa*. 'African Hemp' is properly 'African Bowstring Hemp' and from an East African *Sansevieria.*
77	The vernacular equivalent '*Saganara*' (which see, also *Saganara Matha*) is applied in the South to an *Agave* fibre; on the other hand *Saganara, Saugu*, etc., *may* be given to the *Marsdenia* as well, if it occurs in Coromandel, or the fibre may have been from *Sansevieria.*
77	The scientific name is Sprengel's (Syst. Ed. XVI, Vol. 2, p. 93). His plant seems to have been a *Cordyline*, or at all events not a *Sansevieria* and was from Madagascar; Martius, however, evidently meant to refer to Roxburgh's *Sanseviera*. Cf. *Pitta Ahetz*, etc.

Name	Authority	Language	Where used	Scientific denomination
Bramarakashie	Madras Exh. Cat. 1857	Tamil	S. India	*Agave sp*
Bramha bakasi	Balfour (Cyclopædia)	Do	Ditto	*Agave americana*
Bromelia pita	Squier (also Dodge)	Spanish	Mexico	*Bromelia sylvestris*
Broomboot	Kew Sel. Papers Add. Ser. II. Arts. LXXIX, LXXX (also Dodge)	English	Cosmopolitan	Epicampes macroura Ruiz.
Brush fibre (1)	Madras Exh. Cat., 1855	English	S. India	*Agave Cantala*
Brush fibre (2)	...	Do.	England and America	.....

Page	Remarks
96	See the next, and *Rakas*.
96	Cf. *Rakas*, etc. 'Brahm' or 'Birm' is prefixed to the names of various prickly plants throughout India.
93	The history of this '*pita*' is much tangled, but it is quite clear that the true '*Pita bromelia*' (? a local Spanish name) is furnished by one or other of the *Bromeliaceæ* and not by any *Agave*. Confusion has arisen because the term '*Ixtle*' or '*Istle*' (which see) is applied in some parts of Central America to one or more *Bromeliaceæ*, in others to one or more of the fibre *Agaveae*, while in N.-W. Mexico it applies to the '*Lecheguilla*' or '*Cabbage*' Agaves, which are the main source of '*Tampico fibre*.' Chief Justice Temple of the High Court at Belize (Brit. Honduras), in a paper read before the Society of Arts in 1857 (Vol. V., p. 125) explained the distinction between the *Euagave* fibre and the '*Silk grass*' of Honduras, which is the *Bromelia Pita*, or closely akin to it, and contrasted samples of the *Honduras Silk grass* or *Pita Bromelia* with samples of *Henequen* (*Agave sisalana*, Perrine or a near ally). See also *Istle*, *Silk grass*, *Brush fibre*, and *Pita Bromelia*.
...	In the Indian Agriculturist of December 12th, 1891, in an article on Brush-making and Brush staples in India, it is stated,—"*Mexican is produced in South America from the American Aloe* (*Agave Americana*) *and is very largely used in brush-making, &c.*" Under *Aloe fibre* (3) the use of Agave fibre for brush-making *in India* has been treated.* The fibre known to the trade in England, however, is not got from any of the *Agaveæ* at all, but from a true grass (Nat. Order *Gramineæ* genus *Epicampes*). This is called '*Mexican*,' or '*French*' Whisk as distinguished from the original '*Venetian Whisk*,' which is a *Chrysopogon* (also a true grass) common in S. Europe, also in the Himalayas; see *Brush Fibre*. 'Broom *root*,' it may be noted, is again quite a different thing from 'Broom *corn*,' a *Sorghum* (Nat. Ord. Gramineæ) which abounds in parts of India, and has been carried to the U. S. A., where it is locally grown and used for brush-making. Brushes are made throughout India, usually by gypsies, from the roots or stems of different grasses, in Madras called 'Broom sticks.' See *Aloe Fibre* (3), *Bromelia Pita*, *Brush Fibre*, *Mexican Fibre* (1) *Mexican Whisk*, *Istle* (1), &c.
96	Dr. Riddle of Hyderabad exhibited samples of cloth made wholly or in part with the fibre of a plant described as '*Agave Cantula*,' also furniture brushes made from the remnants of the Aloe fibre. In N.-W. India it is said of Agaves (E) and (J) that the 'butt' of the leaf yields a coarser fibre suitable for brush-making. Rude brushes are made from the leaf of certain species in S. India, as from different Agaves in W. Mexico, by simply cutting off the base of the leaf from the blade, and using the 'neck' as a handle. See also *Aloe fibre* (3), *Broom root*, and *Reju*.
96	Largely obtained from *Agaves* of the *Littaea* section, not so far naturalized in India. See *Mexican fibre*, *Ixtle* (3), *Tampico fibre*; and Cf. *Aloe fibre* (3), *Broom root* (1), *Mexican fibre* (1) also the preceding.

* *i.e.*, as '*Mexican*' fibre.

Name	Authority	Language	Where used	Scientific determination
Puddu Katta-le Naru	Watt E. D.	Canarese	S. India	*Agave americana*
Bulbil	Baker and others	English	...	...
Butt	...	Do.	...	Agaveæ spp.
Cabuja	Martius, also Dodge	Spanish	Antilles	*Furcraea gigantea*
Cabulla (1)	Dodge	Do.	Central America (Costa Rica)	*Furcraea tuberosa*
Cabulla (2)	Squier	Do.	Central America (Yucatan)	*Agave sisaiana*
Cabuya	Seemann (Voyage of the Herald, Botany, p. 216.)	Do.	Central America (Panama)	*Fourcroya tuberosa* Ait.
Cajete	Martius	Do.	Central America (Mexico)	*Agave americana*
Cajun	Dodge	Do.	Central America	*Furcraea cubensis*

Page	Remarks
96, 105, &c.	Kattale = *Aloe*, &c. Nar = *Fibre.*
81	A young plant sprouting from a flower shoot in the place of a seed vessel on the flowering stem or 'scape' of certain *Agaveae.* All the species dealt with in this Bulletin are believed to produce bulbils, notably (D), (E), (G), (H), (J·) A to (K) we have no certain information. The (usually thickened) base or stalk of the leaf in *Euagave* and *Furcraea.*
94, 95	Variously spelled as *Cabouya,* and *Cabuya*—(origin unknown, but perhaps provincial Spanish); often regarded by Spanish writers as=*Agave americana.* Apparently first mentioned by *Oviedo* ('Cabuya') as an inhabitant of the West Indian Islands. Martius, (in the '*Beitrag*') hesitated between '*F. gigantea*' and *F. cubensis;* in the Flora Brasiliensis he gives *F. tuberosa* for the *Cabuya* of the islands and the mainland equally. Dodge says the *Cabuya* is *F. gigantea,* and that *F. tuberosa* is '*Cabulla*': for *F. cubensis* he gives other names. See *Cabuya, Hayti Hemp, Mauritius Hemp,* &c., and the next also.
105, 129	Dodge notes that samples from Costa Rica resembled Sisal fibre (*i.e.,* our G). The origin of the name is not known, but Piso remarks of his *Caragata guacu* usually identified with *Furcraea tuberosa* Ait. that its 'root' is like an onion. This *Furcraea* is apparently unknown, so far, in India. See the next item, also *Caraguata-guacu.*
83, 89, 99, 105, 109, 117, 128, 135, 139, 142, 147	Squier says expressly that this name is applied to the fibre of *Yashqui* and of *Sacqui* which he speaks of as 'varieties' of '*A. sisalana.*' (= G of this Bulletin). Perhaps the Costa Rica fibre mentioned by Dodge was really fine 'Sisal,' but Squier may have been misinformed; Piso notes that from his *Caraguata guacu* a very fine fibre suitable for 'hammock-cloth' was made: we suspect that statements which ascribe the finer kinds of '*pita*' to the *Agaveae* are often erroneous, and that the fine sorts of thread are more commonly derived from different little known *Bromeliaceæ.*
129	*Furcraea tuberosa* Ait. Found on the volcano of Chiriqui. Seemann says the fibre of the leaves is very strong and used for making ropes and hammocks.
105, &c.	The basin which is scooped in the centre of the leaves of certain *Agaves* (*A. atrovirens,* Karw. also *A. cochlearis* Baker, &c., according to Rose) to collect the sap for fermenting 'Pulque.' The liquor is drawn off daily with a long gourd (acojote) and the face of the basin (cara) scraped to promote a fresh flow of the liquor.
94, 95	Wight figures as *F. gigantea,* Vent. a *Furcraea* (Ic. 2025) which may be *F. cubensis,* Vent. (See *Mauritius Hemp,* &c.).

Name	Authority	Language	Where used	Scientific determination
Cantala (1)	Asiatic Researches VI, 230	Sanscrit	N. India	*Agave?*
Cantala (2)	Ainslie	Sanscrit	N. India	*Agave vivipara*
Canton Hemp	Martius	English	India, &c.	*Musa troglodytarum textoria*
Caragate	Moerman	French	Belgium.	...
Caraguata (1)	Kew Bull. Sel. Papers Addl. Ser. II. Art. XXXVIII	Spanish	S. America (Paraguay)	*Bromelia argentina*, Baker
Caraguata (2)	Martius	Do.	Antilles	*Fourcroya cubensis*

Page	Remarks
130	The *Botanical Observations on Select Indian Plants* were interrupted by the death of Sir William Jones, and the List gives nothing further; but the plant was very likely our *Agave* (D), which has been known in Bengal for a considerable period, though the author's query shews that he was well aware that it could hardly have been there when Sanscrit was a living language. *Roxburgh*, who was better acquainted probably with Agave (E), which is naturalized in Coromandel, fitted the name Cantala to that. See the next, *Kantala* and *Kuntala*, also *Kantal*, &c.
130	When Buchanan brought Agave (J) to notice it appears to have been regarded in Bengal as a var. of Roxburgh's *A. Cantala*, but the name assigned by Buchanan to his plant gradually superseded Roxburgh's as regards this supposed variety. Meanwhile the Sanscrit epithet was transferred to the 'variety' (which Roxburgh probably had never seen) from the *A. Cantala* of Roxburgh, and finally, when his *Cantala* was lost from the Calcutta Garden, *Agave* (E) was confounded with the altogether different *Agave* of Wight (J), so that '*Agave vivipara*' of Wight (which is doubtless that of Buchanan and Ainslie) has been very commonly supposed to be the Indian *Cantala*. Whether Cantala had ultimately anything to do with *Agave* is a different matter, as to which see *Kantal* and *Kathal*.
...	From the botanical identification this should be = *Musa textilis*, but *Agaves* also are reported to have been cultivated on the Chinese Coast, as a supplement, most probably, to the true Manila fibre.
97	'Or Spanish Barb—another species of vegetable hair.' *Tillandsias* yielding '*Crin vegetal*' are no doubt intended. See *Agave palo*,— and *Barba de palo*. A common Spanish American name is 'Barba de Vello' where 'Barba' = 'rootlets'—'fibre.' Cf. the following.
93	'*Caraguata*,' which is variously rendered as *Caroata*, *Cravata*, *Grawatha*, also, perhaps, *Curratow*, *Coratoe* or *Keratto*, *Karata* and *Karatas*, is a comprehensive term applied from the coasts and islands of the Caribbean Sea to the Argentine to different species of *Bromeliaceæ*, belonging chiefly to the genera *Bromelia*, *Karatas*, *Tillandsia*, with perhaps *Billbergia* and *Aechmea* also. In Columbia, and adjoining States it seems to be used for one or more *Furcraeas*. The *botanical* genus *Caraguata* is not known, at present, to include any economic species. The Paraguay *Caraguata* was exhibited at Paris in 1889, and was ascertained at Kew to be derived from a then undescribed *Bromelia*. There are at least two kinds of southern *Caraguata*, viz.:—*Caraguata de agua*, and *Caragata ibera*, one of which remains to be identified. See *Ibera*, also *Istle*, *Mexican fibre*, *Silk grass*, *Curratow* and *Keratto*.
94, 95	It is not clear whether Martius regarded *Caraguata* as the Carib name of *F. cubensis* (or F. *cubensis* and F. *tuberosa*) as distinguished from F. *gigantea* ('pita'), but the home of the *Furcraeas* was more likely on the mainland, near the Isthmus, though they may have spread to Cuba first and thence back to the mainland from the eastern *Antilles*.

Name	Authority	Language	Where used	Scientific determination
CARAGUATA (I)	Piso De Ind. Utr. Re. Nat. etc. Amst. 1658	Spanish	S. America (Brazil, etc.)	Bromelia Pinguin, Linn.
Ditto (II)	Do.	Do.	Ditto	Furcraea tuberosa, Ait.
Ditto (III)	Do.	Do.	Ditto	Aloe, Sp.
Ditto (IV)	Do.	Do.	Ditto	Bromeliacea?
Ditto (V)	Do.	Do.	Ditto	Karatas, Sp.
CARAGUATA ACANGA	Do.	Do.	Ditto	Bromelia Pinguin, Linn.
CARAGUATA GUACU	Do. (Also Marcgraf acc. to Martius).	Do.	Ditto	Furcraea tuberosa, Ait.
CARATA	Martius	Carib	West Indian Islands	*Agaveae* and *Bromeliaceae*
CARATAS	Labat (in Martius)	French	Antilles	*Furcraea cubensis*
CARAUA	Dodge	Brazilian (Lingoa geral)	Brazil	*Bromelia* Sp.
CARDON	Gomara	Spanish	Central America	Agave Spp.

Page	Remarks
98, 108, 117	See *Caraguata acanga.*
98, 117	See *Caraguata guacu.*
98, 108	Usually identified with *Aloe vera* L.; however that may be, it is *not* a *Furcraea* or *Euagave.*
98, 108, 117	Perhaps a *Billbergia* or allied *Bromeliacea,* but at all events neither a *Euagave* nor a *Furcraea.*
98, 108, 117	Manifestly a '*Nidularium*' from S. America and by the description of the fruit *Karatas Plumieri,* E. Morren. This is not impossibly the *Caraguata de agua* of Kew Sel. papers XXXVIII [see *Caraguata* (1)].
98, 108, 118	Rightly identified by Sloane with the common Penguin of the West Indian Islands. There has been hopeless confusion with regard to these *Bromeliaceæ,* with the result that this *caraguata* has been credited with fibre: it produces a fruit, eaten in the Islands and in parts of S. America, but the fibre is reported to be worthless. The *Bromelia acanga* of Linnæus (according to the Index Kewensis) was partly *Bromelia Pinguin* of the Sp. Pl. and partly *Karatas Plumieri,* E. Morren. See *Caroata.*
98, 117, 118	See *Cabulla* (1). This *Furcraea* is not naturalized or used so far in India; we have not recognized it even in gardens. As a fibre producer it is believed to have some advantages over the other *Furcraeas.* (See *Mauritius Hemp*). The name is probably the *Caroata assu* of the Tupi dialects in Spanish dress.
97, 98, 108	Martius identifies the plant of Maregraf with *F. cubensis,* but see *Caroata-assu.* He considers that this was the original Carib name for sundry *Agaveae* and *Bromeliaceae* and that Carib war-canoes took the plants and their names to the mainland of S. America. The *Furcraeas* may have come to the Orinoco delta from the Eastern Antilles, but they were probably brought to the Islands by the agency of man from the Peninsula or Isthmus previously.
97, 98, 108, 125	Cf. *Bois de Méche.* Possibly two names are involved, one referring to a *Furcraea,* the other to a *Bromeliad.*
98, 108	See *Caroa.*
110	Meaning 'Thistle' or 'Artichoke' and referring to the prickly nature of certain *Euagaves*; applied to plants of the *Cactus* kind also.

Name	Authority	Language	Where used	Scientific determination
Caroa ...	Martius	Tupi Indian	Brazil	*Billbergia variegata*, Schult.
Caroata	Martius	Tupi Indian	Brazil	*Bromelia karatas*
Caroata Assu	Do.	Do.	Do.	*Fourcoya gigantea* and *F. cubensis*
Carow	Purchas (in Sloane)	Brazilian?	Brazil?	*Aloe Yuccae foliis*
Catecomer	Garcia	Malayalam	South and Western India	Aloe Sp.
Catevala	Rheede Hort. Malab. XI. t. 3.	Do.	S. India	Do.
Cauthaulay	Madras Exh. Cat., 1855	Canarese	S. India (Mysore)	Aloe Sp.
Cebar	Garcia	Arabic	Turkey, Persia, etc.	Aloe Spp.
Cebu Hemp	Dodge	English	Philippines	*Musa textilis*
Century Plant	Squier (and others)	Do.	North America (U. S. A.)	*Agave americana*
Chaparay	Martius	Chayma Indian	S. America (Orinoco Delta)	*Agave americana*
Chauga nara	Madras Exh. Cat., 1857	Telegu	S. India (Rajahmundry)	*Sanseviera Zeylanica*

Page	Remarks
98	Cf. *Caraguata* (1) also *Caraguata* IV (of Piso). The plant of the younger Schultes is identified with *B. speciosa* of Thunberg.
98, 108	*Bromelia Karatas* (see Index Kewensis) is *Karatas Plumieri*, E. Morren, a pineapple-like plant of the Caribean region, reported to yield strong but soft fibre. See, however, the preceding, *Ibera, Istle Mexican fibre, Silk-grass,* etc., also *Caraguata* (1), and *Carow.*
94, 95, 98, 108, 117.	This appears to be the *Caraguata guacu* of Marcgraf (see above), but Piso's plant is evidently neither of the *Furcraeas* named but *F. tuberosa* Ait. Confusion may have arisen over DeLaet's *Nequametl*: Martius identifies the Tobago plant as *F. cubensis,* and no doubt correctly: but Marcgraf's *Caraguata guacu* was Brazilian.
98, 116	Sloane has included two sets of names, if not more, under his *Aloe Yuccæ foliis;* one series evidently refers to the fibre-yielding *Bromeliaceae,* another to the *Sisal* group of *Euagave,* or to *Furcraea.* The "*Carow*" of Purchas' traveller was perhaps the same as *Caroa* and referable to *Billbergia* or *Karatas.*
113	Spelled *Catecomor* by Linschotten and Bauhin. The first part is perhaps the same as that of the *Kadanaku* or *Catevala* of Rheede and may represent a 'Persian' form (Kadi or Kazi) given to local names derived from Kanta (thorn):—for the second part cf. *Kunwar* etc.
113	From 'Kantewala' (*i.e.,* thorny) ? See also *Kadanaku.*
113	Doubtless a rendering of *Kattale.* See *Country aloes.*
113	Cf. *Acebar,* and *Azul,* also *Sabar,* etc.
...	From *Cebu,* one of the Philippine group of Islands.
99, 111	Given to the garden kinds of *Agave* from a tradition started by Borel that the species first introduced into Europe flowered when the life of the plant attained a hundred years, and not earlier.
96	Martius compares this with *Azul Champahra* (q.v.). *Chapara* in Spanish means a kind of Oak, but the true oaks (in Panama at least) seem to be called *Cerro.*
77	Cf. *Saganara,* and *Sauga.*

Name	Authority	Language	Where used	Scientific determination
Chelem	Perrine also Schott (in Engelmann)	Maya Indian	Central America (Yucatan)	**Agave** Sp.
China grass (1)	Roxburgh	English	East Indie	*Sanseviera Zeylanica*
China grass (2)	Watt E.D.	Ditto	Cosmopolitan	*Boehmeria nivea*, Hook. and Arn.
Chinguirito	Jackson	Spanish	Central America (Mexico)	*Agave americana*
Chini Kalabanda	Ainslie Mat. Med. ii. 160	Telegu	S. India	*Aloe littoralis*, Koenig
Chom	Dodge	Maya Indian	Central America (Yucatan)	*Bromelia Pinguin*
Chota Kanwar Ka Patta	Ditto	Hindustani	Central Ind (Deccan)	*Aloe littoralis*, Koenig
Chouca	Ditto	Spanish	Antilles	*Agave v vipara*
Chucumci	Engelmann	Maya Indian	Central America (Yucatan)	*Agave rigida* Mill.—*var.*
Chucau	DeLaet (in Sloane)	Peruvian	S. America (Peru)	*Aloe secunda*, &c.

Page	Remarks
145	According to Engelmann, Perrine and Schott described under this name a wild *Euagave* of Yucatan which they supposed (or were informed) was the wild original of *Yashqui* and *Sacqui* (q.v.)= *Agave sisalana*, Perrine and *Agave longifolia*, Engelmann of this Bulletin. There is no sufficient evidence at present that either of these plants exists in a wild state in Yucatan or elsewhere; but it is just possible that Perrine referred to the Euagave known as *A. decipiens*, Baker (K of this Bulletin). When the text was written we were not aware that Dr. Perrine had introduced several distinct kinds of *Euagave* from Yucatan into Florida. *Agave ixtlioides* of Bot. Mag. is near Baker's *A. decipiens*, and was supposed in the same way to resemble *Agave Ixtle* of *Karwinski* from Yucatan which was credited with 'Ixtle' fibre. See also *Ixtle, Silk Hemp, Silk grass* and *Ixtli.*
77	Roxburgh conjectured that the China grass of his time, used for fishing lines, &c., was obtained from this plant. As Sir George Watt has already pointed out, we do not really know what the modern *China grass* is produced from, or whether it is always got from the same species; but the *China grass* of present commerce is ascribed to species of *Boehmeria* (of the Nettle family, Nat. Ord. *Urticaceae*) see *Canton Hemp* also *Bowstring Hemp* (1).
...	The *Rhea, Ramie, Ortie blanche*, &c.
96 &c.	Brandy made from the sugarcane (molasses presumably) as distinguished from *Agave* spirit, *Aguardiente de maguay*, which see, also *Aguardiente.*
113	In Malayalam *Chennā Nayakam.* Cf. *Kadanaku* also *Jeeni kattalai.*
145	Cf. *Chucumci.*
113	From the earlier accounts of Western India both the *Aloe* and *Agave* seem to have been called 'Kanwar,' *i.e.*, 'thorny,' the *Aloe* being the lesser, the *Agave* the greater *Kanwar* respectively.
121, 127	This looks like a French rendering of some Spanish or Carib name. Whatever the plant may be it is not so far identified with Agave (J) of this Bulletin = Wight's A. vivipara: but it is perhaps the plant mentioned by Martius (Beitrag, p. 10) as figured by Oviedo in his supplementary Ms.
83 to 146	Not identified; reported by Schott as yielding a coarse fibre. Cf. *Chom.*
85	Identified by De Laet with 'the Maguey of the Mexicans':—the *Aloe secunda* of Sloane is *A. americana* of Linnæus.

Name	Authority	Language	Where used	Scientific determination
Chululqui	Martius	Maya Indian	Central America (Yucatan)	*Fourcroya cubensis*
Cocuy	Squier	Spanish	Central and S. America (Venezuela and New Grenada)	Agaveæ Sp.
Cocuyza	Do.	Do.	Ditto	Ditto
Cogollo	Martius (also Rose)	Do.	Central America (Mexico)	*Agave sp.*
Cometico	Nelson	Do.	Ditto	*Do.*
Coquise	Martius	Do.	S. America (Columbia)	*Agaveæ Spp.*
Coratoe	Martius (quoting Long's Jamaica)	English	Jamaica	*Foucroya cubensis*
Coratto	Patrick Browne	Do.	Jamaica	*Agave americana*
Corazon	Martius also Dodge Rose and others	Do.	Central America (Mexico)	Agave Spp.
Country Aloe fibre	Madr. Exh. Cat., 1857	Do.	Central India (Hyderabad)	*Agave sp.*
Country Aloes (1)	Madras Exh. Cat., 1855	Do.	S. India (Mysore)	Aloe Sp.?
Country Aloes (2)	Do., 1857	Do.	Ditto	Ditto

Page	Remarks
98, 117, 145, 146	It is not clear what Martius supposed his *chululqui* to be ; he refers the fibre of Yucatan to several species, such as *Furcraea cubensis*, *F. tuberosa*, *Agave Jacquiniana*, *A lurida*, *A. Ixtle*. At present the only species known to yield *Sisal Hemp* are *A. sisalana*, Perrine and *A. longifolia*, Engelmann.
110	See *Maguay de Cocuy*.
110	Ditto, and Cf. *Coquise*.
...	The central cone of leaves in certain *Agaves*:—in the species that yield 'Tampico fibre,' the 'cogollo' is removed from the living plant to be treated for fibre.
...	A Mexican beverage made from certain species of *Agave*.
110, 117	Meaning not traced. Cf. *Cocuyza*.
117, 124	See the next, also *Great American Aloes*.
117, 124	Browne supposed his plant to be the same as the *A. americana* of writers on Mexico, but Martius referred it to *Fourcroya cubensis*, which the description will not suit, we think. He lays stress on its detergent properties. See *Keratto*, also *Caraguata* (1).
9	The 'heart' or central cone of the Pulque-yielding *Euagaves* at poling time, which is removed to make the cavity for sap collection (*Cajete*).
96	This item is one in a long list headed '*Agave* sp.,' which, however, also includes '*Aloe perfoliata* ropes,' &c. Under Part I we have not mentioned the true aloe as a source of fibre, because evidence of its present use is wanting. Cf. the next, and *Country aloes* (2).
96	As the same local list (for Mysore) contains *Long Aloe* (*A. vivipara*) and *Short Aloe* (*A. americana*), and 'cauthaulay' is given as the equivalent, the '*Country aloes*' fibre should have been from a true aloe, but *Kattali* is now the name at Bangalore of an *Agave*.
96	('Or *Cuthala nar*'.) If this was the same fibre as the *Country aloes* of 1855, it may have been from an *Aloe*; Royle supposed that it was from an *Agave* and the experiments have been quoted for *Agave americana* by subsequent writers. There seems no doubt that cordage has been made in S. India with fibre from the true *Aloe*, but not recently at least on a commercial scale.

Name	Authority	Language	Where used	Scientific determination
Coztic Metl	Hernandez	Aztec	Central America (Mexico)	Agave Sp.?
Cravata	Martius	Brazilian	S. America (Brazil)	*Agaveae* and *Bromeliaceae*, Spp.
Cravata de Rede	Do.	Ditto	Ditto	*Bromeliaceae* ?
Crowia	Morris	Indian dialect	S. America (British Guiana)	*Ananas sativa*, Linn.
Cuba Hemp	Guilfoyle	English	Australia	*Furcraea gigantea*
Cumabi	Rheede	Brahmin language	S. India	*Aloe* Sp.
Curaca	Patriek Browne (also Sloane)	Spanish	Jamaica	*Agave* Sp.
Curratow	Spon	Brazilian	S. America (Brazil)	*Bromelia Sagenaria*
Cuthala Nar	Mad. Exh. Cat., 1857	Canarese	S. India (Mysore)	...
Cuttalay	Royle	Tamil	S. India	Agave Sp.
Cutthalay Nar	Do.	Canarese	...	Do.
Dagger Plant	Dr. Bidie (1877)	English	S. India	*Yucca gloriosa*
Elephant Agave	Government Botanist Madras	Do.	S. India (Tinnevelly)	Agave Vera Cruz, Mill.

Page	Remarks
109	Martius suggests *Agave americana*, but the description hardly fits any *Euagave*. Perhaps a *Manfreda*. Also given as *Macoztic Metl* and *Metl Coztli*.
98	See *Caraguata* (1).
98	Meaning 'Net' or 'Hammock' *Caroata*. See also *Curratow* and Cf. *Reda aonas* of India.
98, 154	Im Thurn ascribed the *Krowa* or *Crowia* fibre to a *Bromelia*, but the plant at Kew has been identified by Sir Daniel Morris as the pine-apple. The word is presumably the same as *Caroa*. Also spelled *Krowa*. Cf. *Caroa*.
94, 95	More than one species of *Furcraea* seems to have been tried in Australia, and one kind at least is grown on a considerable scale in Queensland. From the name this should be the *Furcraea cubensis* of Ventenat, but we do not know what the species of *Furcraea* really are that are grown or used in any of the countries interested.
113	A Sanscrit epithet (referring to the goddess *Durga*) applied to the true *Aloe*. See also *Catevala*.
124	= *Coratto*. See also *Keratto*.
96	The scientific name appears to be taken from *Arruda da Camara* whose plant is said by Martius to be called *Cravata de Rede* (*Ananas bracteatus* of the younger Schultes). Also called *Grawatha* according to Spon. Cf. also *Caraguata* (1).
96	This was one of a series of ropes received at the Madras Exhibition of 1857 of which the breaking weights were carefully tested by the Arsenal Staffs at Bangalore or at Madras, and the result elaborately recorded, but without avail, as it is impossible to say what the plants were that supplied the fibre. See *Country Aloes* (1) and (2), *Pooty Mungem*, &c.
96	*i.e. Kattale*; which is properly=true *Aloe*. Cf. *Kattali*.
...	*Nar*='fibre' in several of the S. Indian languages apparently. Cf. *Cuthala Nar*, and *Kattali*.
78	Also called 'Spanish Dagger,' 'Spanish Bayonet,' etc., in different countries.
83, 86, 147	(D) of Bulletin. Probably a translation of '*Anai Kattale*.'

Name	Authority	Language	Where used	Scientific determination
Enequen	Purchas (in Sloane)	Carib	America	Agave or Furcraea Sp.
Enuga Kala-bantha	Government Botanist Madras	Telegu	S. India (Gantur)	Agave Vera Cruz, Mill.
Enuga Kala-bonda	Ditto	Do.	S. India (Kistna, Nellore)	Ditto
Enuga Kala-bunda	Ditto	Do.	S. India (Kistna, Nellore, Kurnool)	Ditto
Erikatali	Watt E. D.	Canarese?	S. India (Bellary)	*Agave vivipara*
Espadillo	Booth in Kew Sel. Papers (Add. Ser. II) LXIV	Spanish	Central America	Agave, Spp. ?
False Sisal	Kew Sel. Papers (Add. Ser. II) LIX	English	N. America (Florida and Bahamas)	Agave decipiens, Baker.
Fayal Lace	Dodge	Do.	N. America, etc.	*Agave americana*
Filo de pita	Liotard	Portuguese	Portugal	*Agave americana*
Fily Agulha	De Lecluse	Spanish	Spain (Valencia)	*Aloe americana*

Page	Remarks
97, 117	See *Henequen* and *Sisal Hemp*.
83, 86, 147	(D) of Bulletin. *Cf. Yenuga Kalabanda, etc.*
83, 86, 147	Ditto Ditto Ditto.
83, 86, 147	Ditto Ditto Ditto.
131	Probably Agave (J) *i.e.*, our *A. Wightii*.
93	Mr. Booth notes that the Brush fibre exported through Matamoras may be from the *Palma loca* (See *Palma*) or from various forms of the *Espadillo*. We do not know to what plants *Espadillo* is applied, but it is perhaps a version of the Mexican '*Ixtle*' [see *Ixtle* (3) and *Mexican fibre* (1)] and applied in part to one or more *Euagaves*.
77, 82, 83, 92, 106, 141 to 143, 146	This is probably one of the Yucatan *Euagaves* of which local (Maya) names are given by *Perrine, Schott* and *Martius*, and may be their 'Chelem' or 'Wild Henequen'. It may further be the *Agave ixtlioides* of *Karwinski* and the *A. rigida* (wrongly so-named) of Engelmann (not of Miller). It has run wild in Florida, and was imported by mistake as *Sisal* to the Bahamas. Known only in Botanic Gardens in India. It is not in good repute as a fibre-yielder, but it can readily be distinguished.
96, &c.	A valuable kind of lace, formerly prepared in Fayal (Azores group) with thread prepared from the fibre of an *Agavea*, perhaps *A. americana*, Linn. or *A. Vera Cruz*, Miller. The comparative abundance of one or more Agaves in the Atlantic Islands (including St. Helena) is remarkable, but their introduction is due probably to human agency, though the bulbils are believed to survive immersion in sea-water.
96	This term is said to stand in Spanish also for the fibre of '*Agave americana*.'
111, 114, 126	See *Aloe americana*. The plant of which De Lecluse took an offset from Valencia to Antwerp was very likely our D=*Agave Vera Cruz*, Mill., but that which the Dutch introduced to N. Europe (from the West Indies, or by way of the Far East) is different, being *A. americana* of Bot. Mag. 3654 and, earlier, of Linnaeus. The Valentian name means '*thread and needle*.' Cf. 'Eve's thread'=*Yucca filamentosa*; *Adam's Needle* (above); and 'Anana de Agulha' applied in S. America to the fibre-yielding *Ananas bracteatus*, Schult. In the Spice Islands the Dutch settlers called an *Agave* 'Naeldendraet' which had probably a like signification.

Name	Authority	Language	Where used	Scientific determination
Fique	Dodge	Spanish	S. America (Ecuador)	*Fucraea gigantea*
Ghaipat	Liotard	Hindustani (Deccani)	S. W. India (Ahmednagar)	*Yucca gloriosa*
Ghaymari	Do.	Ditto	S. W. India (Ratnagiri)	*Agave vivipara*
Ghee Koomar	Roxburgh	Bengali	N. India (Bengal)	*Aloe* Spp.
Ghi Kunvar	* Pharmacographia Ind.	Hindustani	S. W. India	*Aloe vera,* Linn.
Ghikwar	Stewart Panjab Plants, p. 232	Panjabi	India (Panjab)	*Aloe perfoliata*
Ghrita Kumari	Asiatic Researches, XI —156	Sanscrit	N. India	Aloe spp.
Giant fibre lily	Guilfoyle	English	Australia	*Furcraea gigantea*
Grass Hemp	Ditto	Ditto	Ditto	*Agave rigida*
Grass silk	Hakluyt's Voyages (in Sloane)	Ditto	America (probably New Grenada)	*Aloe Yuccae foliis*
Gratte Gratteuse	Kew Sel. papers (Add. Ser. II) LXVI	French	Mauritius	...

Page	Remarks
94, 95	Dr. Ernst identified this with the *Cocuyza* of Cumana, and both with '*Furcraea gigantea.*'
78	Cf. (for the vern. name) *Bilati pat* and the following.
131	Probably Agave (J); but the local name looks like a corruption of the following.
113	See '*Ghrita Kumari.*'
113	To be distinguished from *Bara Kunvar*, etc., which are species of *Agave*. This is perhaps the original vernacular from which *Ghrita Kumari*, etc., have originated; for the second component see *Kunvari* if the first be a gloss also then compare *Kia*, etc.
113	Also called *Kwar Gandal*, 'gandal' being 'bulb,' and 'kwar'= 'kanvar.'
113	This appears (see *Pharmacographia Indica* p. 468, for origin and other forms) to be based on an older name of some plant, indigenous or anciently established, in Western and North-Western India e.g., *Aloe indica* of Royle. If the true *Aloe* has been introduced on the coasts of India, it evidently had arrived before the *Agaveae*.
94-95	This reads like a book name, but is quoted as actually in use by more than one authority. It is not current in India. See *Mauritius Hemp* also.
146	Dr. Guilfoyle evidently meant *A. sisalana*, Perrine, = (G) of this Bulletin.
116	Under this Latin name Sloane has quoted several different plants, one of which may be *Agave sisalana*, Perrine: '*Grass silk*' or 'Silk of grass' (Hariot in Hakluyt) was perhaps a *Bromeliacea*: Sloane's own 'silk grass' is identified with *Henequen* and 'Hernandez' '*Pati.*' Among doubtful synonyms he cites Hariot with a query, also Fitch (in Hakluyt) who attributes a fine fibre to 'a grass which they call Yerva.' What 'they' in Fitch's day called 'Yerva' (*Erva babosa*) in the Brazils was *Aloe vera* Linn, but Fitch seems to have meant a product of '*Orixa*,' *i.e.* Orissa in the E. Indies (? *Sansevieria*). See *Silk Grass*, &c.
...	A machine for scutching the fibre of the Mauritius Hemp (*Furcraea* spp.).

Name	Authority	Language	Where used	Scientific determination
Gravata	Martius	'Lingoa Geral' (Brazil)	S. America	*Bromelia Karatas*
Grawatha	Spon	Do.	Ditto	*Bromelia Sagenaria*
Great Aloe	Balfour (Cyclopædia)	English	S. India	*Fourcroya gigantea*, Vent.
Great American Aloes (1)	Cleghorn (Forests and Gardens of S. India)	Do.	Ditto	*Agave americana*
Great American Aloes (2)	Long (in Martius)	Do.	Jamaica	*Fourcroya cubensis*, Haworth
Green Aloe	Liotard	Do.	S. India (Mysore)	*Agave vivipara*
Grey Aloe	*R.E. P.	English	India	**Agave Vera Cruz**, Mill.
Guamara	Dodge	Tupi Indian	S. America (Brazil)	*Karatas Plumieri*
Guapila	Rose	Mexican	Central America (N. Mexico)	*A. falcata*, Engelmann
Gul Shabo	R. E. P.	Persian	N. India (Patankot, Panjab)	**A. Cantala** Roxb.
Hampe	...	French	France and French Colonies	...
Hane-a-Cane	Martius	English	America	**Agave and Furcraea** spp.

* Reporter on Economic Products to the Government of India.

Page	Remarks
93, 98	See *Caraguata* (1), *Caroata*, &c.
98	See *Curratow*.
96	See the next.
96, 124	We have not discovered what the Lesser American Aloe may have been in Europe, but the *distinction* dates back to the earliest days of *Agave* cultivation. Ventenat was probably contrasting his plant with *Furcraea tuberosa*, and one kind of the Mauritius Hemp may have been called the Great Aloe in contrast with another; but Cleghorn's use is that of most English horticulturists.
97, 98, 108, 117, 124, 121	For other 'English names,' see the preceding and the next; also *Country Aloes, Grey Aloe, Hedge Aloe, Hill Aloe, Long Aloe, Short Aloe, Wild Aloe, Seaside Aloe*, etc.
121	No doubt a *Furcraea* (see *Sime Kattale*). The Madras Exhibition Catalogue for 1855 includes fibre from Cuddapah ascribed to '*Agave viridis*.' There is no such species known to botanists, and the fibre probably was from one of the *Furcraeas*. The leaves of the Indian *Furcraeas* are usually of a lighter shade and brighter green than those of the *Euagaves*, and the name recalls the 'Aloes Vert' of the Mauritius—a term not in use in Europe, apparently, where '*Green Aloes*' since the days of Rauwolf's Travels (Book III, p. 315) has referred to a true *Aloe*.
83, etc.	Referring to the 'grey' or 'blue' (glaucous) tint that is usually conspicuous in (D) of this Bulletin.
93, 98	Cf. *Istle*. Dr. Ernst identifies the (Venezuelan?) product with this name as 'Bromelia Pinguin.' '*Guama*,' again, is from a totally different order of plants (*Lonchocarpus* Nat. Ord. *Leguminosae*).
...	Mr. Rose regards Engelmann's '*falcata*' as perhaps identical with *A. striata*, Baker, which is Mr. Booth's 'Palma loca.' See *Mexican fibre*, etc.
88, etc.	(E) of this Bulletin. Planted for hedging, and perhaps naturalized in the Kangra Valley and neighbourhood [See *Adam's Needle* (2) also]. Fibre is made from the leaves; and the 'poles'—like those of (D) in the Agra Province— are used for litters (note by Burkill). *Gulshabbo* (*i.e.*, 'Evening-perfumed-flower') is properly the Tuberose (*Polianthes tuberosa*, Linn.).
79	The 'pole' or scape, *i.e.*, flowering stem,—of *Agaveae*.
97	According to Martius a corruption of Henequen. We have not encountered it.

Name	Authority	Language	Where used	Scientific determination
Hathi Chingar	Mukerji, also Watt E.D.	Hindustani	N. India (Oudh)	*Agave vivipara*
Hathi Sengar	Watt E.D.	Ditto	India	*Agave americana*
Hayti Hemp	Bernardin (in Dodge)	English	N. America ?	*Furcraea gigantea*
Hedge Aloe (1)	Madras Exh. Cat. 1857	Do.	S. W. India (Poona)	**Agave** Sp. ?
Hedge Aloe (2)	Cameron (Bangalore Cat.)	Do.	S. India (Mysore)	*Aloe barbadensis*, Mill.
Henechen	De Laet (in Sloane)	...	Antilles	*Aloe Yuccae foliis.*
Henequen (1)	Oviedo (in Sloane)	...	Do.	Ditto
Henequen (2)	Martius	Haitian	Antilles (San Domingo)	**Agaveae** spp.

Page	Remarks
131	*Hathi*=elephant; *Chingar* probably means a 'claw,' or 'thorn;'—Mukerji does not give the locality.
96	Cf. the preceding.
94, 95	From an article by Mons. M. F. Fasio at p. 342, Journ. d' Agriculture Tropicale, No. 41, 1904, it appears that in Algeria, where *Agave* is utilized on a commercial scale for fibre, the French experts are familiar with three 'Aloe-fibre' species, viz. (1) *A. americana* so called, which we believe to be our Agave (D), naturalized and planted in Algeria; (2) '*Sisal*' or '*Henequen*,' which should be our (G) or a closely allied species; (3) *Pite d' Haiti* which from Barnardin (quoted by Dodge) is '*Agave foetida*,' commonly identified with *Furcraea gigantea*, Ventenat, and the '*Mauritius Hemp*' (which see, also *Pite*, etc.). Mons. Fasio has recently exhibited in Paris (at the Musée Commercial de l' Office Colonial) a superior staple of the class of 'Hayti Hemp' (and 'Sisal') which he gets from a plant naturalized in Algeria, referred by him to *Agave* without further identification or description. This may be the second naturalized *Agave* of S. Spain and N. Africa which some authorities have referred to '*A. mexicana, Lamarck*; but that,—in so far as it is anything beyond a name,—was a *Furcraea*.
96	Possibly *Agave* (*D*).
96	C. G. Hope is quoted for the identification.
116	See the next.
Do.	Sloane cites *Oviedo* without question; also *Purchas' Voyages*. Martius will have it that Oviedo's *Henequen* was a *Furcraea*, and this may be so; but Sloane's *Aloe Yuccae foliis*, based on the Henequen of early English travellers on the mainland, was pretty certainly one of the Yucatan *Euagaves*, which, as cultivated for the fibre, have a very Yucca-like aspect. For other references by Sloane, see *Anana de Pite*, *Carow*, and *Grass silk*, also *Pati*.
97, 117	Martius supposes that the *Henequen* and *Pita* of the islands were derived mainly from species of *Furcræa*, and that some of these with the Haitian or the Carib names were transplanted to the mainland, where they extended to different other plants, some belonging probably to the *Bromeliaceae*. There is probably much truth in this as regards the northern shores of S. America, but in Yucatan the fibre industry came, according to tradition, from Mexico, and the native home of the Sisal group of Euagave is rather to be looked for on the Pacific slope of C. America. Mr. Dodge remarks that 'Nequen' was a native Mexican word; and the dominant races who maintained the cultivation of different *Euagaves* both for mead and cordage came from the N. West or South and not from the islands. Whatever may have been the ancient history of the word it is now applied in the chief markets to the *Yucatan* fibres, and to those of the *Sisal* group more particularly. See also *Sisal Hemp*, etc.

Name	Authority	Language	Where used	Scientific determination
Henequen (3)	Perrine	Maya Indian?	Central America (Yucatan)	**Agave sisalana**, Perrine, and connected species
Henequen (4)	Barnardin (in Dodge)	Spanish	Central America	*Yucca filamentosa*
Henequen Hemp	Guilfoyle	English	Australia	**Agave sisalana**, Perrine
Hennequen	Oviedo	Haitian	Antilles	**Agave** and **Furcraea** sp.
Hennequin	Perrine	Maya Indian	Central America (Yucatan)	**Agave sisalana**, Perrine
Hennequinitos	New York Exh. Report, 1853 (quoted by Squier)	Spanish	Do.	Do.
Hill Aloe	Ainslie Mat. Med. 1813	English	India	**Agave Wightii** of this Bulletin
Huci Metl	Hernandez	Aztec	Central America (Mexico)	**Agave** sp.
Huila	Rose	Spanish	Central America (Mexico)	*Agave* sp.

Page	Remarks
89, 144, 145	In 1834 Dr. Perrine, U. S. Consul at Campeachy, submitted a report to his Government on the fibres of the Yucatan Peninsula, in which he described the '*Henequen*' as fibre made in Yucatan from different kinds of *Agaveae*, of which he selected the 'Yashqui hennequin' as the best for cultivation in his own country. In 1838 he introduced different species from the Peninsula of *Yucatan* to that of *Florida*, where his life was sacrificed during an incursion of the Indian tribes from the interior. Since his time '*Henequin*,' or, as it is now usually spelled, '*Henequen*' has become a fibre of first rate importance in several countries, and Perrine's selected species has been introduced successfully into Bengal and Mysore in India. It is said that other staples have been largely mixed at the ports of the Gulf of Mexico with that got from the *Euagaves*, but the term '*Henequen*' is still properly applicable to the best qualities of Yucatan *Euagave* fibre. (See also *Sisal Hemp*.) It must be remembered at the same time that the sort mostly grown in that Peninsula is not Perrine's '*Sisalana*,' though closely resembling it. For outside countries Perrine's is believed to be superior to it.
78	This is no doubt quite correct as regards some local usage. Under *Aloe Yuccae foliis* Sloane quotes Hermann and other authors who had intended either forms of Yucca, or of the small *Agaves* that have 'thready' leaf-margins, none of which have yet been tried on a market scale in India.
146	This seems to be well known and appreciated in parts of Australia.
109	Oviedo's actual spelling. See Henequen (2) for details.
146	So spelled, apparently, in Perrine's original report, which we have not seen, nor his articles in *Silliman's Journal*. We have followed Engelmann es regards the spelling in this case. Cf. *Henequen* (3), etc.
81	*Bulbils* or young plants developed on the parent branches in the place of seeds by a process of proliferous germination in *Euagave* and *Furcraea*.
91, 131	We include these and other terms, though the books are somewhat out of date, because they are not unlikely to recur locally in the course of business.
109	See *Coztic Metl*. (We have not been able to give more than a few of the names in Hernandez).
...	Cultivated near Bolanos in the state of Jalisco for fibre. Species not determined. Identified with the *Bastard Tequila* (which see also *Tequila*).

Name	Authority	Language	Where used	Scientific determination
Ibera	Kew Sel. Papers (Add. Ser. II), XXXVIII	Brazilian	S. America (Paraguay, etc.)	*Bromelia* sp.
Imbira branca	Martius	Tupi and other native Indian languages	S. America (Brazil, etc.)	*Funifera* sp.
Istale	Squier	Spanish	Central America (Mexico)	*Bromelia sylvestris*
Istle (1)	Do.	Do.	...	Ditto
Istle (2)	Temple in Journ. Soc. of Arts, Vol. V, p. 125	Mexican	Central America (British Honduras)	Ditto

Page	Remarks
93, 98	See *Caraguata* (1) and the following.
...	From the works of Humboldt and Martius it appears that several different kinds of fibre known in S. America under variations of the word *Embira*, e.g., *Imbira*, *Ibera*, and their compounds (e.g., *Macembira*) are obtained from species of *Ananas*, *Bromelia*, *Funifera* (Nat. Ord *Thymelaceæ*), *Lecythis* (N. O. *Myrtaceæ*), *Apaiba* (N. O. *Tiliaceæ*), and *Bombax* (N. O. *Malvaceæ*). These 'Embira' fibres are apt to be confused with each other and with those of the *Agaveae*. See also *Macembira*, and *Caraguata* (1).
93, 98	A patch of *Istle* cultivation, or *Pinuella* farm, so called in the country bordering on the Gulf of Campeachy (see the next and *Ixtle*).
93	Spon, under *Nidularium Karatas* (see *Ixtle*), following partly Squier, partly independent authorities, notes that a Bromeliad yields a good and cheap fibre called 'Ixtle' in Mexico. This has been called in question, but is certainly correct (see the next and *Ixtle*), 'Istle' is a simpler way of spelling '*Ixtle*,' where the 'x' is the Spanish equivalent for certain sounds of 's.' *Istle*, *Itzle*, *Ixtli*, *Ixtly*, *Ixtilli*, *Iztl*, *Ystle*, *Yztli* are apparently one word in various disguises, but unfortunately the same shape has come in cases to mean very different things, if not on the spot, at all events in markets and offices.
93	The plant which the Chief Justice of Honduras brought to notice so far back as 1857 was undoubtedly one of the *Bromeliaceæ*, and there is little doubt that it yields a long fine fibre of superior quality. Later evidence shows that this plant or another closely resembling it is found in abundance all along the sub-tropical coast belt from the Gulf of Campeachy to the Vera Cruz neighbourhood. What '*Bromelia sylvestris*' may be and what the *Istle* plant is (if there be only one species in the tract mentioned), we have no immediate knowledge; but Sir D. Morris' matured opinion points to the *Karatas Plumieri* of Morren—*Nidularium Karatas* of Lemaire (see the preceding, *Caraguata* (1) and connected references). This plant is identical, as we suppose, with a Bromeliad which is established in the Sibpur Garden and seems very much at home in its surroundings, but this is not known to have been raised on a commercial scale as yet in India. This staple would probably have taken better hold in the U. S. A. and in the English colonies but for a series of mistakes as to local names and geography. It has been confounded with the small *Agaves* of the '*Tampico fibre*' series [see *Ixtle* (3), *Tampico fibre*, etc.], though these are produced in a totally different part of Central America; also with the fibre *Exagaves* of the Yucatan Peninsula [see *Bromelia Pita*, *Silk Grass*, *Sisal Hemp*, etc.]; and, further, with the *Bromelia Pinguin* of Linne, ('Penguin' of the West Indies), which produces a fruit, but a very sorry fibre apparently [See *Caraguata* (1) of Piso]. The '*Pita Bromelia*' (*i.e.*, Honduras *Istle*) seems to be known in the local Spanish very generally as *Pinuella* (pronounced 'Pinyuella'). *Pina* (pinya) is the pine-apple; *Pinuella* represents one or more 'wild pineapples' or fibre-yielding Bromeliads.

NAME	Authority	Language	Where used	Scientific determination
ITZLE	Dodge	Mexican	Central or S. America	...
IXTILLI	...	...	Ditto	*Agave* sp.
IXTLE (1)	Squier	Mexican	C. America (Isthmus of Nicaragua, etc.)	*Bromelia sylvestris*,
IXTLE (2)	Spon	Ditto	C. America (Mexico)	*Nidularium Karatas*
IXTLE (3)	Rose	Ditto	Ditto	Agave sp.
IXTLE MESCAL	Dodge	Ditto	Ditto	*Agave Wislizeni*
IXTLI (1)	...	Ditto	Central America (State of Vera Cruz)	Karatas Plumieri, Morr. ?
IXTLI (2)	Martius	Maya Indian ?	Central America (Yucatan).	*Agave Ixtle*, Karwinski

Page	Remarks
	= *Ixtle*?
83, 84, 101, 140, 141, 147	Evidently *Ixtle:* applied to an *Agave* said to be naturalized in Burma, if that be the same with one cultivated at Saharanpur in N.-W. India—Agave (A) of our list, which again is very like a form cultivated at Kew from the Turks or Caicos group of islands (in the Bahamas). When Parts I and II were written we were not aware that Perrine had introduced more than the one species of *Agave* into Florida, but it seems that he planted out several Euagaves,—all from Yucatan apparently (some were for experimental purposes most likely). This gives special interest to the plant illustrated in Miss Mulford's Plates 60 and 61 and an undetermined Agave from the Perrine grant (S. Florida), which is in all probability one of Perrine's imported Euagaves (see Dodge's Plate III). We have followed the American authorities in leaving this plant without name pending further information, but in the light of the above it evidently merits examination as a source of fibre. It is not unlikely that the *Agave Ixtli* of Karwinski from Yucatan received its specific name on the supposition that it was the fibre 'Istle' of the country; this, if not actually the same as Baker's *Agave decipiens* (the false Sisal), is very near to it, and may be the 'wild' kind of Engelmann. Perrine may, we think, have imported (among others possibly)—(i) *A sisalana*=(G) (ii), *Agave* (A), and (iii) *A. decipiens*, Baker=(K); and if there is or was an Euagave known as *Ixtle* in the Maya country, our A and not Karwinski's plant perhaps represents it. How it has become naturalized in Burma remains to be discovered.
93, 98	Possibly in part the same as Temple's *Istle*, i.e., *Istle* (2). Major Barnard (U. S. A.) reported on it from the Isthmus of Tehuantepec (Gulf of Campeachy), but diverse products were perhaps included under the one name, at least one being probably an *Agave*.
93	See *Istle* (1), *Mexican fibre*, *Pita pinuella*, and *Silk grass*. Spon's contributor has unfortunately confused the *Istle* of S. E. Mexico and Nicaragua with that of the dry north (Zacatecas, Tula, Sinaloa, Coahuila, etc.), for which see the next and '*Tampico fibre*.'
93	The species of *Agave* which yield '*Tampico fibre*' (chiefly used in brush-making) belong for the most part to a different section of the genus from the *Euagaves*. None have been so far planted in any part of India except here and there in gardens. See also *Broom root*, *Brush fibre* (1) and (2), *Mexican fibre*, *Tampico fibre* and *Reju*.
98	This belongs to the *Euagave* section, but has nothing to do with the *Mescal* of the southern parts of Mexico. It is practically unknown in India.
93	A spelling (more correct perhaps) of *Ixtle*, which see, also *Istle* (1) and (2).
146	See *Ixtilli and Yxtli*.

Name	Authority	Language	Where used	Scientific determination
Ixtly	...	Aztec ?	Central America (Mexico)	...
Jafirabad Aloes	Pharmacog. Ind.	English	India	Aloe, sp.
Jamaica Kerratto	J. G. Baker	Do.	England	*Agave Morrisii*, Baker
Jangli ananas	Balfour (Cyclopædia)	Hindustani	India (Bengal, &c.)	*Agave americana*
Jangli anás	Pharmacog. Ind.	Ditto	S.-W. India	Ditto
Jangli Kunvara	Watt E. D.	Ditto	India (Guzerat)	*Agave americana*, Linn.
Jeeni Kathalai	Govt. Botanist, Madras	Tamil	S. India (Salem)	Agave Vera Cruz, Mill.
Jenequen	Schott (in Engelmann)	Maya Indian (in Spanish form)	Central America (Yucatan)	*Agave* sp.
Jungli	Dodge	Bengali	India (Bengal)	*Agave americana*
Kadanaku	Rheede	Malayalam	S. India (Malabar coast)	Aloe sp.
Kadi	Forskohl Fl. Aeg. Ar. p. 172.	Arabic	Arabia Felix Yemen.	*Keura odorifera.*
Kalabanda (1)	Pharmacog. Ind.	Telegu	S. India	*Aloe vera*, Linn.
Kalabanda (2)	Govt. Botanist, Madras	Tamil	S. India (Nellore, Cuddapah)	Agave Vera Cruz, Mill.
Kalabantha	Balfour (Cyclopædia)	Do.	S. India	*Agave americana*
Klabonda	Govt. Botanist, Madras	Telegu	S. India (Anantapur, Nellore, Bellary)	Agave Vera Cruz, Mill.

Page	Remarks
...	A variation of *Ixtle*. See *Istle* (1) and *Yztli*.
113	A sort of bitter aloes made at *Jafirabad* in Guzerat by families claiming African descent.
91	From the description this Euagave would seem near to our *Agave* (*H*), but we think the Indian plant is allied rather to the '*Sisalana*' group, including (E) and (F), and a likely fibre-producer. See *Keratto* also.
96	Meaning 'wild pineapple.' We have not met with the expression.
96	Cf. the above, also *Nanas utan, Reda aonas*, etc.
96	Cf. *Bara Kanwar, Kunvar*, etc., also *Gritha Kumari*: the species may be (D) = *A. Vera Cruz*, Mill.
86, 147	From *Jin* (a demon)? but cf. *Chini Kalabunda*.
144	Another spelling of *Henequen*, which see. We do not know precisely what Schott meant by the term, not having his original report before us. Engelmann ascribes all the best Yucatan fibre to '*A rigida*, Miller,' and its supposed varieties, *sisalana* and *longifolia*, but Schott seems to have relied a good deal on local accounts, and his *Jenequen* may have included fibre from other sources. See *Sisal Hemp* also.
96	'Ananas' (or the like) has evidently dropped out in printing. See *Jungli ananas* above.
113	Sometimes spelled Kadenaku. The first two syllables are probably Kanda, or Kanta, 'a thorn.' See also *Catevala, Cumari, Kenda* and *Kunvar*. The Persian and Arabic *Kadhi* (Qazi) and *Kadi* (Cadi) are perhaps glosses on the first component of the Indian name.
95	Cf. the preceding, and *Keura*.
96	We have not been able to discover the meaning of this widespread name,—but see *Kalbanda* and *Klamanda*.
87, 147, &c.	Cf. the preceding. Many changes have been rung on the spelling.
96	= the preceding.
87, 147	No doubt a variant of *Kalabanda*.

Name	Authority	Language	Where used	Scientific determination
Kalabunda	Ainslie Mat. Med. 1813	Telegu	S. India	**Aloe** sp.
Kalabuntha	Liotard?	...	S. India (Madras)	*Aloe perfoliata*
Kala Kantala	Balfour Cyclopœdia	Sanscrit	India	*Agave americana*
Kalbanda	Fallon (Dict.)	Hindi	India	*Aloe perfoliata?*
Kalkali	Do.	Hindi (Tirhut dialect)	N. India (Bengal)	Ditto
Kalnan	Dodge	....	India	*Agave* sp.
Kalnar	Liotard	Hindustani (Deccani)	India (Bombay)	Ditto
Kan	Dodge	Maya Indian	Central America (Yucatan)	*Agave rigida*
Kantala	Pharmacog. Ind.	Sanscrit	India	*Aloe vera, Linn.*
Kantal	...	Bengali	N. India (Bengal)	*Artocarpus integrifoltia, Linn.*

Page	Remarks
113	It seems almost as if in Telegu *Kalabanda* were the true aloe; in Tamil the *Agave*.
113	The first fibre products from 'Kalabuntha' sent to Europe from Madras (by Dr. Hunter) were ascribed to a true aloe. Later *Agave* fibre was sent from the same quarter under the same name of *Kalabantha*.
96	Cf. *Kalabanda* and *Kuntala*.
96, 113	'Kal' in 'Hindi,' etc. '=evil,' 'bastard,' 'degenerate,' etc. 'Banda' in Hindustani=parasite or epiphyte (e.g. Loranthus). See also *Klamanda*, of which possibly *Kalabanda* may be a corruption.
96, 113	See the preceding.
...	Perhaps taken from the following.
...	Cf. *Kalbanda*, *Kalkali*, and see *Nar*. Reported from the S. Mahratta country.
143	Evidently one of the *Euagaves* of Yucatan or a *Furcraea*.
113	An epithet of the true *Aloe* meaning '*thorny*.' Cf. *Catevala*, *Kadanaku*, etc., and see *Cantala*, *Kathal*, *Kuntala* and the following.
	See *Kathal*. This was also possibly a *Kantala*. The jack fruit is perhaps only introduced in N. India, but very anciently. The pronunciation and spelling vary: this has both the vowels fairly broad (accented).

Name	Authority	Language	Where used	Scientific determination
Kantala (1)	Stewart (Panjab Plants, p. 232)	Panjabi?	Panjab?	*Agave Kuntala*, Roxb.
Kantala (2)	Watt E.D.	Sanscrit	India	*Agave vivipara*, Linn.
Kantala (3)	Prain (Vegetation of Hughli-Howrah, and 24-Parganas)	Bengali	Bengal	*Agave Vera Cruz*, Mill.
Karao	Moerman, (The Ramie etc.)	Japanese	Japan	*Boehmeria* sp.?
Karaoata	De Laet (in Sloane)	Carib?	Antilles	*Ananas sylvestris*, *Brasiliana*, Herm.?
Karata	Du Tertre (in Sloane)	French	Do.	Ditto
Karata Sauvage	Do.	Do.	Do.	*Aloe Yuccae folius*

Page	Remarks
130	This native name is not current in N.-W. India so far as we know, and was taken possibly from Roxburgh, whose specific name is wrongly quoted. Roxburgh's own spelling of it varied; in the Hort. Beng. it is *A. Cantala*: in the Flora Indica *A. Cantula*. We have followed the former for our (E), of which we have seen no Panjab examples except from the Kangra Valley and neighbourhood. Mr. Burkill, however, has observed it in the Satlaj basin from Suket to below Simla.
100, 127 133, 136	Under Part II it has been explained why we do not follow Wight in identifying his plant with the *A. vivipara* of Linnaeus. As regards 'Kantala,' Linnaeus most certainly never saw *Agave* (J) (*i.e.*, *Wight's* vivipara), nor probably did Roxburgh, and Roxburgh's species, which is our (E), is altogether different. In his first accounts (which give a high place to the fibre), Roxburgh wrote of it as a new species. Later he seems to have referred it to '*A. americana*.' Ultimately it was published as *A. Cantala*. Whether it was the *Kantala* of the *Asiatic Researches* is doubtful. Voigt and Colebrooke very possibly supposed that Wight's plant was a native—and the original *Kantala*, but the plant which Roxburgh identified with Rumpf's illustration is our *Agave* (*E*) and not Wight's *vivipara*. From an economic point of view the distinction is material, for the leaf of (J) has been found to be too short for fibre extraction on a commercial scale, whereas fibre prepared from (E) ranks in the market. The *A. vivipara* of Baker in the *Gardener's Chronicle* is by description *A. vivipara* of Wight not of Linné but plants now in cultivation at Kew ticketed *A. vivipara* belong to *A Cantala* Roxb.
86, 88	Our (D) = *A. Vera Cruz*, Mill. '*A. lurida*' of the Sibpur Garden (*not* of Gawler and others) may have been the plant identified by the Pandits who assisted Sir William Jones and his contemporaries in their endeavours to identify plants mentioned in the Hindu Classics and Pharmacopœia; but we do not think it is the fibre plant on which Roxburgh reported, which was, we consider, Agave (E), i.e., *A. Cantala*, Roxb.
...	Cf. *Carao, Carow*, and *Caraguata* (1).
98	Sloane goes on to identify this with the Jamaica *Penguin*. Hermann's plant was very likely the 'Bromelia sylvestris' of later authors; but if it yielded fibre would more likely be *Karatas Plumieri*, Morren, than *Bromelia Pinguin*, Linn. See *Bromelia pita, Caraguata-acanga* and *Caraguata* (1), also *Istle* (1) and (2) and *Silk grass* for the confusion under this set of names of *Bromeliaceous* fibre plants with *Furcræa* and *Agave*.
113, 117	'A fruit,' and therefore no doubt rightly identified by Sloane with the Jamaica 'Penguins.'
113, 117	A 'pite' without prickles which Sloane thought might be Hernandez' *Pati* and Oviedo's *Henequen* (i.e., a *Furcraea* or a *Sisal Agave*) See *Pite* also.

Name	Authority	Language	Where used	Scientific determination
Karoon Kuttalay Nar	Madras Exh. Cat. 1857	Tamil	S. India (Madras)	*Agave* sp.
Karun Kathali	Govt. Botanist Madras	Do.	S. India (Dindigul)	**Agave Vera Cruz**, Mill.
Karun Kattalai	Do.	Do.	S. India (Coimbatore, Tinnevelly)	Ditto
Katar	Fallon (Dict.)	Panjabi	Panjab	*Artocarpus integrifolia*
Kathal	Do.	Hindi	N. India	Ditto
Kathalai	Watt E.D.	Tamil	S. India	*Agave americana*, Linn.
Kathalay	Balfour (Cyclopædia)	Do.	Do.	*Agave vivipara*, Linn.
Kathali	Govt. Botanist Madras	Do.	S. India (Cuddapah, Dindigul)	**Agave Vera Cruz**, Mill.
Kattal	...	...	...	...
Kattala	Govt. Botanist Madras	Telegu	S. India (Bellary)	**Agave Vera Cruz**, Mill.
Kattalay	Ainslie Med. Mat. (1816). —1-10.	Tamil	S. India	*Aloe perfoliata*, Linn.
Kattali	Cameron (Bangalore Cat.)	Canarese	S. India (Mysore)	*Agave americana*, Mill.

Page	Remarks
95, 113	Exhibited in 1855 from the same district, but source of fibre not named. Cf. the next.
86, 147	= *Agave* (D).
86, 147	= Do.
...	See *Kathal.*
...	Pronounced in Bengal with the last vowel broad (See *Bengal Plants*, p. 971). This has many forms, *e.g.*, Kathail, Kathair, Kath and *Katar*. See also *Kantai*. The allusion is of course to the spine of the Jack fruit. Fibre is said to be got in Burma and N. India from the bark of *Artocarpus* spp. (See also *Trap-tree.*) The Malayan name from which 'Jack fruit' is derived is applied also to the Pineapple (*Kapa-jakka*), while from old works on India it would seem that the 'Jakka or 'Yucca' of Malabar was an *Aloe* or even possibly an *Agave*. *'Kantala'* was perhaps originally an epithet of *Artocarpus integrifolia*, Linn., which must have been known long before any *Agave* had reached India. The difference of the 't' in the two words does not involve any radical distinction, and the current use of *Kantal* is for *Artocarpus*.
96	Usually in combination with a qualifying term, such as 'Anai,' etc. Cf. *Kattali*, etc.
96	Cf. *Cathaulay, Country aloe* (1) and (2) and *Kattali*, but also *Kattalay*.
86, 147	Cf. *Kathali, Kattala, Anai Kattalai*, etc.
...	See *Kathal.*
86, 147	Cf. *Kathali* and see also *Kantala* and *Kathal.*
113	Cf. the next, also *Kathalay, Kathali*, etc.
96	Mr. Cameron gives the Carnatic name for 'Aloe litoralis' as *Lolisaragida.*

Name	Authority	Language	Where used	Scientific determination
Kattali fibre	Madras Exh. Cat. 1855	English	S. India (S. Arcot)	*Agave* sp.
Kattaly	Do., 1857	Canarese ?	S. India (Madura)	*Agave* sp.
Kea	Roxburgh (Hort. Beng.)	Bengali	Bengal	*Pandanus odoratissimus* R.
Kea Kanta	Do.	Do.	Do.	*Pandanus foetidus* R.
Kenda	Watt E.D.	Hindustani	Do.	*Pandanus odoratissimus*, Willd
Keratto	...	Spanish	W. Indies	**Agave** sp.
Ketaki	Fallon (Dict.)	Pali	S. India	*Pandanus odoratissimus*
Ketgi (1)	Do.	Hindi	India	Ditto
Ketgi (2)	Watt E.D.	Do.	Central India (Deccan)	*Agave americana*, Linn.
Ketki (1)	Fallon (Dict.)	Do.	India	*Pandanus odoratissimus*
Ketki (2)	R. E. P., Govt. of India.	Do.	Central India (Berar)	**Agave Wightii** (of this Bulletin)
Ketki (3)	Liotard	Guzerati	Western India (Kathiawar)	*Pandanus odoratissimus*
Ketukee	Roxb. (Hort. Beng.)	'Sanscrit'	India	Ditto
Keura	Do.	Bengali	Bengal	Ditto
Keurkanta	Do.	Hindustani	Do.	Ditto
Khetki	Watt E. D.	Do.	N. India (Oudh)	*Agave vivipara*, Linn.
Kikanora Matha.	Govt Botanist Madras.	Telegu	S. India	**Agave Vera Cruz**, Mill.

* An unpublished coloured drawing however made under the supervision of Buchanan (afterwards Hamilton) and now preserved at Kew, gives *Ketkei* as a vernacular name for a plant which is unmistakeably A. *Cantala*, Roxb.

Page	Remarks
95, 113	Cf. *Kathalay, Kathali, Kattalay,* etc.
95, 113	Do. Do.
...	Cf. *Ketaki, Keura, Kia, Koyan,* etc., and the next. Dodge spells this '*Keya.*' Called '*Kekel,*' '*Keker*' in Malaya.
...	For other names and scientific designations see Bengal Plants, p. 1101. Species of *Pandanus* are native in different parts of India, but those usually found in hedges or near temples in Bengal were probably imported from Malaya.
...	See *Palkande.* Probably a dialectic form of *Kanta.*
117, 128	Originally *Caraguata* (which see) but in Jamaica and other West Indian Islands now commonly applied to species of *Agave* and *Furcraea.*
...	Cf. the next, *Ketki, Ketukee*—and *Ketgi.*
...	Cf. the preceding and following.
96	See the next also, and *Banskeora.*
...	Cf. *Ketaki,* etc
...	In the drier parts of India *Agave Wightii* (J) has made itself at home, and has acquired fairly constant local names, such as *Ketki* and *Banskeora.**
...	Fibre of leaves proposed as a paper stock; identification doubtful, possibly an *Agave.*
...	= *Ketaki.*
...	Cf. *Banskeora*; also *Mellis kyre,* etc.: *Keura* is the ordinary N.-W. Indian name for *Pandanus.* Forskohl (See *Kadi*) notes that a plant which was evidently a Pandanus was grown in S. W. *Arabia* in his day and called Keura by the 'Banians' (*i.e.,* Hindu traders).
...	See *Bengal Plants,* 1101, where '*Keorkanta*' (Bengali) is given for *P. foetidus,* Roxb.
91	Probably (J) brought from the Deccan and planted about forts and settlements by the *Rohillas,* as in the *Ganges Doab.*
86, 147	'*Matta,*' '*Motta*' or '*Matha*' is frequent in the names of *Agaves* in S. India (from Mata=Devi?); for '*Kanora,*' cf. *Kanur, Kunvar;*—and for the first syllable *kea, ghikomar,* etc.

Name	Authority	Language	Where used	Scientific determination
Kithali nara Matha	Govt. Botanist Madras.	Telegu	S. India (Ganjam)	**Agave Cantala**, Roxb.
Kithanara	Do. ...	...	S. India (Godavari)	Ditto
Kitki	Stewart (Panjab Plants, p. 232)	Hindi?	Panjab	*A. Cantala*, Roxb.
Kitta Nar	Madras Exh. Cat. 1857.	Telegu	S. India (Rajahmundry)	*Agave* sp.
Kittanara	Balfour (Cyclopædia)	Tamil	S. India	*Agave Cantala* Roxb.
Kittanara Mattalu	Govt. Botanist Madras.	Telegu	S. India (Godavari)	**Agave Vera Cruz**, Mill.
Kittaulee Nar	Madras Exh. Cat. 1857	Tamil	S. India (Vizianagram)	*Agave* sp.
Klamanda	Do.	Canarese?	Do.	Do.
Koomaree	...	Hindi	India	**Aloe** spp.
Koyan	Mukerji (Descr. Cat. Ind., Prod. Amsterdam etc., 1883)	Bengali	Bengal	*Agave americana*
Kuntala	Roxburgh (Hort. Beng.)	Sanscrit	India	**Agave Cantala**, Roxb.
Kunwar	Ainslie	Deccani	Central and Western India	*Aloe* sp.
Kuttalay	Ainslie Mat. Med. (1826), ii—160	Tamil	S. India, Madras	Do.

Page	Remarks
87, 147	Cf. the preceding, but 'Nara' is here perhaps 'fibre'.
87, 147	Cf. *Anakyitha*.
100, etc.	Stewart cites 'A. vivipara Royle' as a synonym, by which he meant possibly A. vivipara of *Wight* = (J): but from a coloured drawing made under the auspices of Buchanan (afterwards Hamilton) preserved at Kew it appears that the plant known to Buchanan as '*Ketki*' was **A. *Cantala***. Roxb.
147	Cf. the next, also *Kithanara*.
147	This is probably correct: Cf. *Kithanara*.
	Cf. *Kithanara*, etc.
86, 147	The catalogue attributes this fibre (sent by H. H. the Raja of Vizianagram) to an *Agave*, but it may have been taken from *Sansevieria*. The original Coromandel *Kithanara* was most likely A. *Cantala*, Roxb. which is more like a screwpine in the leaf than the other Indian species.
86, 147	Cf. *Munda* and *Kalamanda*, also *Kalabanda*.
113	See '*Cumari*'. The correct transliteration is *Kumari*.
96	Probably from the local name of *Pandanus fascicularis*, Lam. (Bengal Plants, p. 1101).
129, 130, 136	Cf. *Kantala* and *Cantala*.
113	In Guzerati 'Kuvara' or 'Kumara'.
...	Cf. *Bara Kanwar*, *Catecomer*, etc.
113	Cf. Catevala (under *Catecomer*), *Cauthaulay*, *Kattali*, *Kathalay*, etc., Ainslie puts the accent on the second vowel, and says that *Kuttalay* is 'Aloe perfoliata' (Mysore, etc.) 'Aloe littoralis' being properly '*Sirooghoo Kuttalay*'. See *Small Aloe* also.

Name	Authority	Language	Where used	Scientific determination
Kutthalai	Brown and Wood	Tamil	S. India, Madras	*Aloe* sp.
Kuar Gandal	Stewart (Panjab Plants, p. 232)	Panjabi	Panjab	*Aloe indica*, Royle
Kyre	Ainslie	Deccani	S. India	*Agave vivipara*, Linn.
Laffa	Et. de Flacourt (in Sloane)	French	Madagascar	*Aloe Yuccae foliis* ?
Lal Murga	Piddington (Index)	Bengali	Bengal	**Celosia cristata**, Linn.
Langue Boeuf	Dodge	French	Antilles	*Furcraea cubensis*
Large aloe fibre	Mad. Exh. Cat. 1855	English	S. India (Tinnevelly)	*Agave sp.*
Lecheguilla	Miss. Garden Rept., 1896 (also Dodge, Rose and others)	Spanish	Central America (Mexico)	**Agave** spp.
Lida Boaya	Rumpf	Malay	Moluccas, &c.	**Aloe** sp.
Lily fibre	Indian Agriculturist, Dec. 12, 1891	English	England	*Agave americana*

Page	Remarks
113	When used without any qualifying addition this seems generally to refer to *Aloe* and not *Agave;* but see *Kattali.*
113	Means "Thorn—onion:" the first part is=*Kunwar,* &c., above.
95	'Kyre,' probably is from *Keora,* or *Keura,* usually in N. India given to Pandanus. Perhaps this word is the same as 'coir' and means simply 'fibre.' Old writers speak of a *Quera'* as yielding fibre near the Portuguese factories. Ainslie attributes his 'kyre' which was a 'strong and useful cordage' to an *Agave,* most likely (J) of this Bulletin. See also *Mellis Kyre* and *Kadi.*
77	This looks like one of the African names of *Sansevieria* (at Angola Ifé=*S. cylindrica,* Bojer) with the French definite article prefixed. Flacourt was Governor of Madagascar in the 17th century, and in Bojer's time *S. cylindrica* was cultivated in the Ile de France as a native of Zanzibar. See also *Anana de pite, Bowstring Hemp* and *Pitte Ahetz.*
...	Spon states that a valuable fibre is obtained from a *Celosia* in India, but, as Sir George Watt observes, 'confirmation of this fact is much required.' *Celosia cristata,* Linn. is cultivated in Bengal as an ornamental plant. *Celosia argentea,* Linn. is an abundant weed with autumn crops throughout N. India. Spon's authority may have been misled by a vernacular name. Cf. *Murga, Moorva,* &c. *Lal Murga* evidently means 'Red Cockscomb.'
94, 95	See *Cabuya, Henequen* (1) and (2), *Mauritius Hemp,* &c.
95, 96	Probably (D).
99	Applied in Northern Mexico and parts of Arizona, Texas, &c., to the 'cabbage' *Agaves,* several of which yield a short stapled fibre (see *Tampico fibre*), and are otherwise of economic interest. Most of these belong to the *Littaea* section of *Agave,* a section quite distinct from *Euagave* to which the *Sisal* group is referable. None are grown at present in India, except here and there in gardens, but in the drier provinces they would probably succeed as a source of *Brush fibre.* Dr. Trelease informs us that Lecheguilla means 'lettuce.'
113	'Crocodile's tongue,' as distinguished from '*Nana boaya*' (crocodile pineapple) which we take to be *Agave Cantala* Roxb.=(E) or a very closely allied species. Blanco gives 'Lidang boaya' as a name of *Aloe* in the Philippines.
99	The article quoted states that this is a white lustrous and superior kind of fibre used in brush making, which is obtained from *Agave americana* in Mexico, and might be abundantly produced in India; but see *Aloe fibre, Mexican fibre* (1), and *Tampico fibre.*

Name	Authority	Language	Where used	Scientific determination
Long Aloe (1)	Rice (Mysore Gazetteer)	English	S. India (Mysore)	Agave sp.
Long Aloe (2)	Madras Exh. Cat. 1855	Do.	Ditto	*Agave vivipara*
Macembira	Martius	Tupi Indian	S. America (Brazil, &c.)	*Bromelia laciniosa*, Mart.
Macoztic Metl	Hernandez	Aztec	Central America (Mexico)	Agave sp.
Madre Pulque	Martius (and others)	Spanish	Ditto	Agave atrovirens, *Karwinski* and other species
Magay	Edwards	Filipino	Philippines	Agave sp.
Maguay	H. B. K.	Do.	Ditto	*Agave americana*
Maguay de Cocuy	H. B. K.	Spanish	S. America (Venezuela)	*Yucca acaulis*, H. B. K.
Maguay de Cocuyza	Do.	Do.	Ditto	Ditto
Magué	Edwards	Filipino	Philippines	Agave spp.
Maguei	Jacquin (Sel. St. Amer.)	Spanish	Cuba	*Agave cubensis*
Magueis	Hakluyt	Do.	Central America (Mexico)	Agave spp.

Page	Remarks
131	Probably Agave (J) *i.e.*, our *A Wightii* (See the next and *Short Aloe*).
131	Ditto ditto ditto.
98	Martius says Maca='hammock' and Embira='string'. *Bromelia laciniosa*, Mart. is believed to be=*Karatas Plumieri* Morren, for which see *Istle* (1) and (2).
109	See *Coztic Metl.*
140	The thickened dregs of the sap of the *Pulque Agaves* left in the 'cajete' or cavity of the plant,—added to the sap after it has been drawn off to promote fermentation.
99	=*Maguey.*
99	Humboldt in his own writings has noted clearly that the *Maguey* he saw in Mexico was planted or cultivated, and that there were several kinds, not belonging to the genus *Agave* exclusively. Kunth in dealing with the botany of Humboldt's travels described only one *Agave* which he referred (erroneously as appears from the works of Rose and others) to the *A. americana* of Linneaus (See also *Pulque, Tequila*, &c.) and stated that this occurred throughout Central America as far N. as Florida. The native place of *A. americana* Linn., is not known, but it seems doubtful if it is found except in gardens even in Mexico. See also *Maguey.*
98	So called at *Caraccas* (at that time) and used for fibre.
98	At *Cumana*, and used similarly. Cf. *Coquise.*
99	This is a provincial spelling in the Philippines. Other versions in the same Islands are *Amaguey* (which see), *Maguie, Maguey*, and *Magui*. The plant or the fibre is called also in some parts *'pita.'* Cf. also *Magui.*
94, 95	*Maguei* appears in Hernandez both for the cider 'Metl,' and for a species which does not seem to be a fibre *Agave*. Jacquin says his Maguei is common in Cuba and used as a detergent. It is a *Furcraea.*
109, 110	The Maguey is so called by early English travellers. Cf. *Magueyes* (2).

Name	Authority.	Language	Where used	Scientific determination
Maguey (1)	Oviedo	Spanish	Antilles	*Agave vivipara*
Maguey (2)	Do.	Do.	S. America	*Agave americana*
Maguey (3)	Peter Martyr (in Martius, also in Danielli)	Haitian	Antilles (Haití)	Agave sp. ?
Maguey (4)	Squier	Spanish	Central America (Mexico)	*Agave mexicana*
Maguey Blando	Dodge	Do.	Ditto	*Agave Salmiana*
Maguey Cimarron	Schiede (in Linnaea)	Do.	Ditto	*Agave americana*
Maguey de Tequila	Dodge	Do.	Ditto	Ditto
Maguey Manso	C. Beni (in Danielli)	Do.	Ditto	*Agave Maximilianea* P. & I Blasquez.
Maguey Manso fino	Dodge	Do.	Central America (District of Mexico)	*Agave americana*
Magueyes (1)	Oviedo	Spanish	Central or S. America	

Page	Remarks
121	Martius says that there is a drawing with the supplement of *Oviedo* which shows as the original *Maguey* a smaller plant than either *A. americana* or *Furcraea cubensis*, and suggests that it may have been *Agave vivipara*, but by this he did not mean perhaps *Agave Wightii* (J) of this Bulletin.
99	Oviedo quoted by *Martius* (Beitrag, p. 10) says that on the mainland in the country of *Araya* there is a nation on whose lands the Maguey is so abundant that they are called 'Magueyes.' The allusion is perhaps to the Maya plantations. From a recent work on Costa Rica reviewed in *Nature* No. 1846, dated 16th March 1905, it appears that parts of the Isthmus were held in the 16th century by a civilized race called *Mangue*.
109	The first mention of Maguey is by this author who says the ancient inhabitants of Haiti had a sort of drum or cymbal which was called Maguey. Martius thinks that these drums may have been made from the scape of an *Agavea*.
125	Squier rightly distinguished the Pulque Agave from the so-called '*A. americana*,' but *Agave mexicana* of Lamarck is a misnomer, and the *Agave mexicana* of Moore (in Gardener's Chronicle) is more probably Agave (F) as to which see '*Tequila*'. Bates (in Stanford's Compendium) also calls the Maguey *A. americana* and supposes that there is only one species throughout the 'Tierra Templada' from Zapotlan eastwards.
85, 147	*A. Salmiana*, Otto is commonly identified with *A. atrovirens* Karwinski, which is said to be one of the chief Pulque Agaves in the State of Mexico. A large *Agave* is met with in gardens on the Continent of Europe under the name of *A. Salmiana*. Our Agave (C) appears to be near this species.
129	Meaning 'Wild Maguey.' Travellers have frequently reported finding '*Agave americana*' wild, but truly wild examples of Linnæus' *A. americana*, of the Pulque Agaves, and of *A. sisalana*, if they exist, remain to be discovered.
95, 96	See *Tequila*.
150 (footnote)	See *Maguey mansofino*. Beni says the scientific name is 'Agave Massimilianaea.'
95, 96	Meaning 'fine cultivated Maguey,' to distinguish a plantation kind from spontaneous hedge *Agaves*. It is unlikely that the term is restricted to the one species. A Mexican writer professes to have distinguished over 16 sorts in the Apam tract alone which is the princial Pulque-making area. He must have taken count of very fine distinctions, but even so the statement is significant.
.....	An Indian tribe of Central America in the 16th century 'named from the Agave.' See *Maguey* (2), but cf. the next also.

Name	Authority	Language	Where used	Scientific determination
Magueyes (2)	Zurita (in Martius)	Spanish	Central America (Mexico)	..
Magui	M. Blanco (Flora de Filipines s.v. Agave)	Filipino	Philippines	*Agave americana*
Magweiz	Hakluyt, etc.	Spanish	Central America (Mexico)	Agave spp.
Malai Kathalai	Govt. Botanist Madras	Tamil	S. India (S. Arcot)	Agave Vera Cruz, Mill.
Malai Kattalai	Ditto	Do.	S. India (Tanjore)	Ditto.
Malay Kuttalay Nar	Ainslie	Do.	S. India	*Agave vivipara*, Linn.
Malino	Coulter	Spanish?	Hawaii	*Furcraea* spp.
Manchi Kalabunda	Govt. Botanist Madras	Telegu	S. India (Cuddapah)	Agave Vera Cruz, Mill.
Manguai	Ditto	Spanish	America	Agave spp.
Manguei	Linschotten (in K. Bauhin)	Do.	Do.	Ditto
Mangurie	Pedro Ordonnez (in Sloane)	Spanish	America	*Aloe secunda?*
Manila	Kew Sel. Papers (Addl. Ser. II), LXVI	English	Turks Islands	*Furcraea cubensis.*
Manila Aloe Fibre	Kew Sel. Papers (Addl. Ser. II), LXII	Do.	Philippines	*Agave vivipara* L
Manjie	Mad. Exh. Cat. 1857	Deccan	India (Hyderabad)	*Agave sp.*
Manjina Naru	Cameron (Bangalore Cat.)	Canarese	S. India (Mysore)	*Sanseviera Zeylanica*, Roscoe

Page	Remarks
...	Maguey farms or plantations were so called by the early Spanish invaders of Mexico.
96	Mr. Edwards notes that this form of the name survives locally. The common naturalized Agave in the Philippines proves to be *A. Cantala*, Roxb.
109, 110	Cf. *Magueis* and *Magueyes* (2).
86, 147	= Agave (D.). Meaning of 'Malai' not known.
86, 147	Ditto ditto.
95, 96	Perhaps Agave (J).
94, 95	Brought from America presumably.
86, 147	Agave (D). Cf. *Manjina Nar, Motta Munjee Nar*, etc.
99	A variant of *Maguey*.
99	Ditto.
116	As Sloane states that *Cabuja* was another name, the plant was doubtless a *Furcraea*.
..	See also Silk grass (4).
138	The naturalized Philippine species proves to be *A. Cantala*, Roxb.
...	Cf. the next and *Munjee Nar*.
77	(Misprint in the botanical name altered.) Cf. *Motta Munjee Mar* and *Manchi Kalabanda*.

NAME	Authority	Language	Where used	Scientific determination
MAQUEY	Booth (in Kew Sel. Papers Addl. Ser. II—LXIV)	Spanish	Central America	**Agave** spp.
MAROOL	Mad. Exh. Cat. 1857	Telegu (and Tamil)	S. India	*Sanseviera Zeylanica*
MARUL (1)	Watt E.D.	Hindustani	India	*Sanseviera Zeylanica*, Wild.
MARUL (2)	Govt. Botanist Madras	Tamil?	S. India (Tanjore)	**Agave Vera Cruz**, Mill.
MAST	Miss. Gard Report 1896 etc.	English	N. America	**Agaveae** spp.
MAURITIUS HEMP	Kew Sel. Papers (Addl. Ser. II) LXV. LXVI	English	Cosmopolitan	**Furcraea** spp.
MAURVI	Asiatic Researches IV. 271.	Sanscrit	India	*Aletris*, Linn.

Page	Remarks
..	A variant of *Maguey*. If this represents the actual sound, the original is possibly 'Ma-qui,' and the second syllable = *Qui*,—*Quil* (q.v.)
77	'Kattalay Nar' from Travancore at the same exhibition was apparently *Sansevieria*, in which case the same *local* name would cover *Aloe*, *Agave*, and *Sansevieria*; but perhaps there has been a mistake in ticketing.
77	This (Murul) is the correct transliteration.
87, 147	Cf. the preceding and *Marool* also.
80-82	Applied in the U. S. A. to the scape or 'pole' of *Euagave* and *Furcraea*.
94-95	It is usual to ascribe this commercial fibre to *Furcraea gigantea* Vent., but the plants grown in S. India do not always, or even ordinarily, answer to that species as defined by Mr. Baker. From the authority quoted by us it is clear that several species of *Agave* and *Furcraea*, to say nothing of *Sansevieria*, have run wild in the Mauritius, while the "Mauritius Hemp" that comes from St. Helena is not perhaps from a *Furcraea* at all, but from the St. Helena *Agave*, (*A. augustifolia* of the Buitenzorg Garden) which may be Agave (E) *i.e.*, *Roxburgh's Agave* = *A. Cantala* of this Bulletin. Wight's S. Indian *Furcraea* (see Part I, p. 19) and *Cajun* above, also the '*Agave viridis*' of Madras Exhibition Catalogues are perhaps *Furcraea cabensis* Ait. which is said to be the best fibre *Agavea* of the West India Islands. Different *Furcraeas* thrive throughout the moister parts of India, and the fibre is being brought into use in N. India also. Certain of the species tend like *Agave* (G.) (*Sisal*), and the Honduras Silk Grass plant [see *Istle* (1) and (2) and *Silk Grass*] to lose the side-thorns (prickles) of the leaf in cultivation. The true *Agave foetida* of Linnaeus grows in the Sibpur Garden, but we doubt its identity with the *Mauritius Hemp* plant of S. India. It seems to be common along the coasts of the Isthmus and the Orinoco region where it yields 'Cobblers thread.'—See *Aloes Vert*, *Cabuya*, *Hayti Hemp*, *Pite d'Haiti*, *Piet*, *Pita de Zapateros*, &c.
77	The *Sansevieria* fibre or Bowstring Hemp of Roxburgh (to be distinguished from the *Marsdenia* or *Jiti* bast, said to be the 'Muruvu Dul' of Ceylon). The name of the plant as distinguished from the fibre was 'Murva' which survives in the Bengali *Murva* or '*Moarba*' (Bengal Plants, p. 1054). Species of *Sansevieria* were at first referred to the genus *Aletris*.

Name	Authority	Language	Where used	Species for determination
Maya	Squier	Cuban	Cuba	*Agaveae spp.*
Maypole	Hughes' Hist. Barbadoes (in Martius)	English	Antilles (Barbadoes)	*Furcraea cubensis*, Haw.
Mellis Kyre	Ainslie	Portuguese ?	India (Deccan)	*Agave vivipara*, Linn.
Mescal	Miss. Gard. Report 1896	Spanish	Central America (Mexico)	*Agave spp.*
Meil	Hernandez (and others)	Aztec	Central America	*Agaveae spp.* also *Bromeliaceae.*
Metl Cotli	Hernandez	Do.	Central America (Mexico)	Agave sp.

Page	Remarks
128	Squier does not say which of the 'varieties' of *Henequen* or *Pita* is so called in Cuba; if it be a *Furcraea* then the reference is perhaps to the mainland opposite where the Maya Indians had their *Henequen* plantations. Great weight attaches to the view that '*Furcraea cubensis*' was taken to the Brazils from the Antilles, but more recent evidence points to the home of the *Furcraeas* being rather in Panama and the neighbourhood. In Venezuela the 'Maya' *fruit* is said to be a Bromelia (*Bromelia chrysantha*).
94-95	Probably one of the fibre yielding *Furcraeas*. Peter Martyr's text suggests that the Caribs worshipped one or other of the *Agaveae*, and a *Euagave* was deified in Mexico. Cf. *Mast* and *Pole* also.
110	Ainslie gives this also as *Mellis Cour* and says it is a smaller sort of cordage or twine than 'Kyre,' but from the same plant. The 'Kyre' or 'Cour' is probably the 'Queura' (Keura) of Garcia and other early writers, which seems to have been applied both to *Pandanus* and *Agave*. 'Mellore' was a Portuguese name for certain species of *Pandanus* including *P. Leram*, Jones; but the 'Mellis' in Ainslie may refer to the flowers of an *Agave*. The Maguey was called 'Honey Tree' and 'Melt,' a false analogy being drawn between 'Metl' and words meaning Honey in the Romance languages of Europe; the flowers, of the Island species particularly, distil honey. (Cf., however, *Agua de Miel*).
98	A spirit made from certain of the *Euagaves* that grow in the State of Mexico. It is called 'Mexical' or Mescal apparently to distinguish it from '*Tequila*,' and '*Mescal de Maguey*' as against *Aguardiente* and *Sotol* (which see, also *Aguardiente* and '*Tequila*').
110	A general name for sundry plants of Mexico (in the wider sense) mostly of the genus *Agave*—usually employed by the Mexicans themselves with a qualifying term to denote the sort intended. When the Spaniards arrived from the Islands they applied to the chief kinds, and particularly the Pulque-yielding species, the name of Maguey, which they had found given to plants of the same class in the Islands (e.g., *San Domingo*), and the early writers appropriated the names *Metl* and *Maguey* to a more or less apocryphal 'tree' which flourishes to the present day in various kinds of literature. *Acosta's* history has given rise to the statement that Maguey in Mexican means 'tree of wonders.' He did not say so, nor is 'Maguey' Mexican perhaps originally, but his '*Arbor de las Maravillas*' is a more or less imaginary plant gifted with the qualities of several different species.
109	See *Coztic Metl*.

Name	Authority	Language	Where used	Scientific determination
Mexcal Metl	Hernandez	Aztec	Central America (Mexico)	Agave sp.
Mexican Aloe	Spon	English	Europe	Agave spp.
Mexican Aloe Fibre	Mad. Exh. Cat. 1857	English	South India	*Agave* sp.
Mexican Fibre	Dodge	Do.	N. America	*Agave heteracantha*
Mexican Fibre (1)	Booth in Kew Bulletin Sel. Papers (Addl. Ser. II) LXIV	Do.	Europe and America	Agave spp.
Mexican Fibre (2)	Spon	English	England	*Nidularium Karatas*

Page.	Remarks
99	Hernandez' figure represents a small 'cabbage' Agave, rather like some of the ornamental kinds seen in gardens, but unknown in India; it seems near *Agave Shawii*, Engelmann, of California, but it may not be an *Euagave*. Its leaves were eaten by the natives as several species allied to *A. Shawii* are to this day by the Apaches, etc., who also prepare an intoxicating beverage from the Mescals of their country but by a different method from that of the South. Zuccarini identifies Hernandez' picture with his *A. heteracantha* (usually regarded as a chief source of *Tampico fibre*) but it looks like certain species since discovered in North Mexico.
96, 125	Given to the '*Agave americana*,' which has been supposed to yield so many economic products. (See *Maguey*, *Pulque*, &c.). About Mexico itself the local *Agaves* are chiefly valued for the sap, while the best fibres, those of Yucatan, come from altogether different species. The name perhaps originated with the '*Agave mexicana*' of the Encyclop. Meth. which is unmaintainable. See also *Pite d' Haiti* and *Tequila*. Mr. Gamble's '*A. mexicana*,' = (F) of this Bulletin, from North India is an altogether different thing from what Spon intended.
125	Also shown (from Madras) in 1857. See the preceding : several species no doubt contributed.
98, 99	Mr. Rose has shown recently that the botanical identity of the plants which yield this, also called (from places of export) 'Tampico fibre,' 'Matamoras fibre' &c., is as yet very doubtful. See the next also.
99	None of the *Agaves* that yield the Brush-making staple so largely exported from ports on the Gulf of Mexico are naturalized or grown on a commercial scale in India, and most of them belong to a different group from that which embraces the Pulque Agaves, with the Sisal Hemp and other long-stapled fibre plants of the order. Mr. Booth's account of the *Tampico fibre* is very clear as regards the trade from Northern Mexico where this class of fibre constitutes the local 'Istle' as contrasted with the *Istle* of the coast from Vera Cruz eastwards, which is from a different natural order. In India, however, good brush fibre has been taken from one or more of the naturalized *Euagaves*. (See *Aloe fibre* (3), *Mexican Whisk*, *Lily fibre* and *Reju*).
93	This is the *Bromelia pita* (for which see above) or '*Istle*' of certain parts of Central America, and altogether different from the preceding, as well as from the *Mexican Whisk* used in brush-making. It has been confused in America and elsewhere with '*Tampico fibre*'; also with the *Sisal Hemp* (See *Sisal Hemp*, *Istle*, *Ixtle* and *Silk Grass*), and in India with *Mexican Whisk*, which see, also the preceding.

Name	Authority	Language	Where used	Scientific determination
Mexican Grass	Guilfoyle	English	Australia	*Agave sisalana*, Perrine (and allied species)
Maxican Hemp	Do.	Do.	Ditto	Ditto
Mexican Whisk	Kew Sel. Papers (Addl. Ser. II) LXXIX and LXXX	Do.	Europe and America	*Epicampes macroura*, Bth.
Mexocotl	Hernandez	Aztec	Central America (Mexico)	Bromeliaceæ Spp.
Mezcal (1)	Dodge	Mexican	Ditto	*Agave potatorum*, Zuccarini
Mezcal (2)	Jackson	Do.	Ditto	*Agave americana*
Mordha	R. E. P., Govt. of India	Bengali ?	Central India (Singhbum)	Agave Vera Cruz, Mill.
Motta Munjee Nar	Mad. Exh. Cat. 1855	Telegu ?	S. India (Madura)	*Agave* Sp.
Munda	Govt. Botanist Madras	Malayalam	S. India (Malabar)	Agave Wightii (of this Bulletin)
Munjee Nar	Mad. Exh. Cat. 1857	Canarese ?	S. India (Salem)	*Agave* Sp.
Muraga	Asiatic Researches, IV. 271	Hindi	India	*Aletris*, Linn.

Page	Remarks.
89, 147	Dr. Guilfoyle says that this name is given to the *Sisal Hemp* fibre (from species allied to *Agave sisalana*, Perrine). It is also mentioned by Dodge in his valuable '*Useful fibre Plants of the World.*'
89, 147	This is no doubt the 'Sisal' introduced into Australia, which we believe to be Agave (G) of this Bulletin. See *Sisal Hemp* also.
...	This has been confused in India with *Mexican fibre* (1) (which see) and with the fibre locally obtained for brush-making purposes from species of *Euagave* naturalized in India. The American product is used as a substitute for fibre obtained in Europe from different *Gramineae* (true grasses) some of which are believed to be abundant in the Himalaya also. In America brooms are made also from an *Aristida* closely allied to species that abound in India, *e.g.*, the 'broom sticks' of the Madras Presidency.
108	Probably *Bromelia Pinguin* Linn. Given with the different kinds of *Metl*, but *not* as a fibre plant.
...	Mr. Rose observes that the *Pulque* and *Mescal* Agaves are of different species in different parts of Mexico. We do not know whether *Agave* (D) is one of them and cannot therefore say whether any have been naturalized in India. See also *Mescal*.
96	A version of *Mescal*. See also *Mescal Metl* and the preceding.
86, 147	Agave (D). Perhaps from the Bengali *Murga*, which see.
95, 96	Cf. *Manchi Kalabunda, Manjee, Munjee Nar*, &c.
91, 147	= Agave (J). Cf. *Kalamanda*. In the *Pharmacographia Indica* it is noted that the true aloe is called *Mandala* because of the scimetar-like leaves.
96	Cf. *Manjee, Motta Munjee Nar*, &c. Doubtfully the same as the 'Fibre of Mungie Plant' shown from Mysore in 1855.
77	Usually now spelled 'Murga.' There are many variations, such as Murva, Murgabi, Murgahvee, Moorgalie, Murva, Murba, Moarba, etc., but all usually refer to the Bowstring Hemp of Roxburgh—a species of *Sansevieria*. (In Ceylon, however 'Muruvu-dul' is said to be the bast of *Marsdenia tenacissima* W. & A.) As a name of *Sansevieria* this has found its way to the West Indian Islands. See *Maurvi* and the next also.

Name	Authority	Language	Where used	Scientific determination
Murga (1)	Watt E. D.	Bengali	Bengal	*Agave americana*
Murga (2)	R. E. P. Government of India	Bengali	Central India (Singhbum)	Agave Vera Cruz, Mill.
Musambra	Pharmacographia Indica (III, 472)	Canarese	S. India	*Aloe* sp. [?]
Mutta Saga	Govt. Botanist Madras	Telegu?	S. India (Ganjam)	Agave Vera Cruz, Mill.
Mysore Aloes	Pharmacographia Indica (III, 472)	English	S. India	*Aloe* sp.
Nanas Boaya	Rumpf	Malay	Amboyna (Malay Archipelago)	Agave Cantala, Roxb.
Nanas utan	Do.	Do.	Java, &c.	*Agave* sp.
Nannas Sabrang	Hasskarl (in 'Flora' II, 1842 p. 5).	Do.	Java (Sunda, &c.)	*Agave Rumphii, Hasskarl.*
Nar	Ainslie	Tamil?	S. India	*Agave, &c.*
Nequametl (1)	Piso	...	S. America	Furcræa tuberosa, Ait.

Page	Remarks
95, 96	It is not quite clear whether the older authorities regarded '*Muraga*' or '*Murga*' as derived from *Murva*. The ordinary word for a gamecock is commonly derived through the Persian from the Arabic, but the wild bird is Indo-Malayan, and 'Murva' is given by some authors as a variant of 'Murgha,' so the word may be originally Indian. In N. India *Sansevieria* is as much an incomer as *Agave* (see Bengal Plants, 1054), and when *Murga* is applied in N. India to *Agave*, the allusion is plainly to the 'terrible spurs' as an American writer calls the spines of certain species. The habit of the leaves in *Sansevieria* may have earlier suggested a fanciful resemblance to the spur of a '*Bantam*.'
86, 147	See the last, and *Mordha*.
113	From the Arabic name of the true Aloe (see *Sabr*, etc.) and common term for the *drug* throughout India, but in S. India locally applied also to a 'size' or 'glue' used in house decoration, much as gilder's size is used in Europe; it seems possible that this is obtained from an *Agave*. See *Mysore Aloes* also.
86, 147	Cf. *Motta Munjee Nar*, *Sagi Mutta*, etc.
...	A species of the true Aloe is understood to be common in *Mysore*, but the gilder's cement or size called 'Musambra' and said to be got from '*Mysore Aloes*' may be from an *Agave*. See *Hedge Aloe* (2) however.
100	Meaning 'Alligator Pineapple.'
102, 114	Meaning 'Wild Pineapple.' From Rumpf's account it would seem that more than one Agave had reached the Indian seas by the middle of the 17th Century, for the merits of the fibre were even then disputed. See also the next and the preceding.
134	Meaning 'Foreign pineapple.' *Hasskarl* himself later identified this with our Agave (E.)=*A. Cantala* Roxb. (see his *Neuer Schlüssel* etc., 1866) and with the 'Nanas Costa' of Java mentioned by Miquel.
95	In several languages of S. India signifies 'cord,' 'thread,' or 'fibre.' In Hindustani it is a 'ligament' or 'sinew.'
94, 95, 129.	This is not Hernandez' *Nequametl* unless the figures have been misplaced by his editor: that looks like an *Agave* of the *Littaea* section, or, as Martius suggests, a *Dasylirion*.

Name	Authority	Language	Where used	Scientific determination
Nequametl (2)	DeLaet	...	Antilles (Tobago)	*Furcraea cubensis* (f. Martius).
Nipi	Blanco (Fl. de Filip.)	Filipino	Philippines	*Agave americana*
Nita	Balfour (Cyclopædia)	Tamil	S. India	*Agave americana, etc.*
Nulkyitha	Govt. Botanist Madras	Malayalam?	S. India (Malabar Dist.)	**Agave Wightii** (of this Bulletin)
Octli	Hernandez	Aztec	Central America (Mexico)	**Agave** Spp.
Ocpatli	Gomara (in Martius, etc)	Do.?	Ditto	...
Offset	. .	English	...	...
Palkande	Dymock (Marathi Names, p. 5)	Marathi	S. W. India	*Agave* Sp.
Palma	Booth in Kew Sel. Papers (Addl. Ser. II.) LXIV	Spanish	Central America (Mexico)	*Agave* and *Yucca* Spp.
Panam Katrazhi	Watt E. D.	Malayalam	S. India	*Agave americana*
Parkand	Ditto	Marathi	S. W. India	Ditto
Patha	...	Panjabi	N.-W. India (Indus Valley.)	**Nannorhops Ritchieana** Wendl.
Pati	Hernandez	..	Central America (Mexico?)	**Agave sisalana**, Perrine ?

Page	Remarks
94, 95	In editing Markgraf's work on the Brasils De Laet added *Nequametl* and a drawing of it as it grew in Tobago; this Jacquin has identified with his *Agave cubensis,* which is taken as = *Furcræa cubensis* of Ventenat.
96	This name is not in Edwards. Blanco says the outer leaves are smaller than in typical 'Americana,' meaning possibly *A. Cantala* Roxb.
96	Fibre of different *Agaveae.*
91, 147	Cf. *Ana Kyitha.*
97	Hernandez does not mention 'Pulque,' but gives *Octli* as the Mexican name, in his day, of the fermented liquor.
98	A herb which was mixed with the Agave mead to give it strength. Hernandez gives two different names for it. The practice continues, and it has been suggested, but probably without due ground, that the thorn apple (*Datura Stramonium,* Linn.) is employed.
81	A lateral shoot from the trunk or stock. In the Indian species of *Euagave* these are given off under ground, but the seedling develops at the surface.
95	Cf. *Parkand.* The 'Kand' is probably='Kanta,' a thorn. See *Kenda,* etc.
98	The earliest mention of the *Agaveae* in the Islands compares the *Maguey* to a palm, and the name is given in Tula, Zacatecas, and other tracts that supply Brush fibre, to different kinds of *Agave* and *Yucca.* Mr. Booth distinguishes the Palma loca, Palma real and Palma bareta. See *Mexican fibre.*
96	Cf. *Anaik Katrazhai,* etc.
96	Cf. *Palkande.*
...	See *Aloe* (2), *Pesh* and *Wild aloe.*
117	This does not seem to be either Spanish or Mexican, and no Aztec equivalent is given. The sketch suggests a *Furcraea, or* Agave (G) (the spineless form). It is called 'Meti lenissimum,' and is said to produce thread of the finest quality.

Name	Authority	Language	Where used	Scientific determination
Pedda Kala-banda Naba	Ainslie	Telegu	S. India	*Agave vivipara*
Peemai Katha-lai	Govt. Botanist Madras	Tamil	S. India (Salem)	**Agave**, Sp.
Peetha Kala-banda	Ditto	Telegu	Ditto	**Agave Vera Cruz**, Mill.
Peetha Kala-bantha (1)	Drury (Useful Plants of India)	Ditto	S. India	*Agave vivipara*
Peetha Kala-bantha (2)	Brown and Wood	Ditto	Ditto	*Agave americana*
Pei Kathalai	Govt. Botanist Madras	Tamil	S. India (Madras, Tinnevelly)	**Agave Vera Cruz**, Mill.
Pemm	Dodge	Maya Indian	Central America (Yucatan)	*Ceiba pentandra*
Pemmanaw	Smith's 'Virginia' (Sloane)	...	N. America ?	*Aloe Yuccae foliis*
Penca	Blanco, &c.	Spanish	Mexico, Philippines, &c.	**Agave**, Sp.
Pesh	Liotard	Beluchi	Beluchistan and Indus Valley border	**Nannorhops Ritchieana**, H. Wendl.
Petha Kala-bantha	Watt E. D.	Telegu	S. India (Bellary)	*Agave americana*, Linn.
Petre	Squier	Spanish	Central America (Guatemala) ?	*Yucca gloriosa*
Piante de cent anni	Danielli	Italian	Italy	*Agave americana*
Piet (1)	J. Commelin (Ed. Kiggelaar)	Dutch	Antilles	*Fourcroya foetida*
Piet (2)	Boerhaave	Do.	Ditto (Curacao)	**Furcraea**, sp. ?

Page	Remarks
91, 92	Probably Agave (J).
83-84	We have not been able to determine the species, but this may be=Agave (A), the Burma species. (See *Ixtilli*).
86, 147	Cf. the following.
138	See *Pita* and *Kalabuntha*.
99	Probably Agave (D) is intended.
86, 147	Agave (D).
...	*Ceiba* belongs to a very different class of fibres from the *Agaveae* viz., the bast of the *Tiliaceae, Sterculiaceae*, etc., but see the next.
98	Possibly a *Yucca* or a *Manfreda*.
...	The outer leaves of *Euagave* as distinguished from the *Cogollo* or *Corazon*. Taken from the artichoke or thistle (cardon).
...	See *Aloe* (2), *Patha*, and *Wild aloe*.
96	Cf. *Peetha kalabanda*.
...	Dodge questions the identification.
96	i.e. *Century Plant*.
94, 95	'*Fourcroya foetida*' should be *Furcraea gigantea*, Vent. Pre-Linnaean botanists knew this as '*Aloe Americana folio viridi, &c.*' and this is probably the origin of '*Aloes vert*' and the '*Agave viridis*' of S. Indian Catalogues. Through the French '*pite*.'
94, 95	Boerhaave says that the thread was used by shoemakers in Curacoa, and that the name was given to the plant from the fibre. Cf. also *Pita de zapateros*, and *Pit*.

Name	Authority	Language.	Where used	Scientific determination
Pinon	Squier	Spanish	Cuba	Agave or Furcraea, sp.
Pinuella	Do.	Do.	Central America (Panama, &c.)	*Bromelia sylvestris*
Pit	Hermann	Dutch	Antilles	Furcraea ?
Pita (1)	Ditto	Spanish or Carib	Ditto	Ditto
Pita (2)	Martius	Carib	Ditto	Agave and Furcraea, spp.
Pita (3)	Ditto	Portuguese	Portugal	*Agave americana*
Pita (4)	Dodge	Spanish	America	Agaveae, Bromeliaceae and Palmae, spp.
Pita (5)	Squier	Do.	Central America (Panama, &c.)	*Bromelia sylvestris*
Pita (6)	Kew Sel. Papers (Addl. Ser. II) XLVI	English	Turks Islands	*Agave rigida* var. *sisalana*
Pita Bromelia	Ditto	Do.	Central America (Honduras)	*Ditto*
Pita de Zapateros	Seemann, Botany. Voyage of the Herald, p. 215	Spanish	Central America (Panama)	*Bromelia karatas*, Linn.

Page	Remarks
98	No doubt from 'Pina,' meaning 'wild pineapple.'
93, 98	'Pina' is the 'Pine apple;' Pinuella = *Karatas Plumieri,* Morr. probably. See *Pita* (3).
94, 95	Boerhaave (Hort. Ac. Lugd. Bat.) quotes Hermann's Par. Bat. Prodr. for *Pit, Pita,* as = an 'Aloe' (Agave). In the supplement to the Par. Bat. the spellling is 'Pitha' cf. *Piet.*
94, 95	Ditto ditto ditto.
97	Martius thinks *Pita* is the Carib equivalent of the Haitian *Henequen,* but leaves it in doubt to what species it was applicable. The Cabuja of the Spaniards was, he considers, a *Furcraea* and the Island *Maguey* was a comparatively small Agave (the '*Palms*' of Peter Martyr) used as a famine food (Oviedo). In another place he says '*Pita*' means 'pipe' (referring to the uses of tobacco in the W. Indies). Whatever its origin the name has spread very widely, and is incorporated with the languages of Southern India.
99	See also *Piteira.*
...	A general term on the Caribean coasts and Islands for the longer staples obtained from *Agaveae* and *Bromeliaceae.* In S. America it is replaced by *Caraguata* and *Ibera* with their variations. *Pita* is often used with a specific addition, *e.g., Pita de corojo* (a Palm fibre), *Pita pinuella* (see the next), etc. In India it is restricted to *Euagave.*
93-98	In Panama and on the adjoining coast *Pita* is or was equivalent to *Istle* (1), or *Pinuella,* which is usually, we think, *Karatas Plumieri,* Morren. Cf. *Bromelia Pita, Istle* (1) and (2), *Pita Bromelia, Pinuella, Silk Grass,* &c.
...	*Agave sisalana,* Perrine—*i.e.* (G).
93-98	This fibre was highly reported on as a fine fibre by London firms many years ago. It is said to be produced from *Karatas Plumieri,* Morren (= *Nidularium Karatas,* Lem.) which we identify with a plant that thrives in the Sibpur garden. See *Istle* (1), *Bromelia pita,* and *Silk Grass.*
93-98	Meaning "*Shoemakers thread.*" The leaves of this plant (says Seemann) furnish a strong fibre. He adds that the thread is extensively used by shoemakers. This is said of other 'Pita' fibres also by various authorities. *Bromelia Karatas* Linn. is = *Karatas Plumieri,* Morren.

Name	Authority	Language	Where used	Scientific determination
Pita fibre	Cameron (Bangalore Cat.)	English	S. India (Mysore)	*Agave mexicana*
Pita flax	Cleghorn (Forests and Gardens of S. India)	Do.	S. India	Ditto
Pita floya	Dodge	Spanish	Central America (Costa Rica)	*Furcraea gigantea.*
Pita Hemp	Do.	Do.	America	**Yucca** and **Furcraea** spp.
Pita Kalabantha	Balfour (Cyclopædia)	Tamil	S. India	**Agave**, sp.
Pite (1)	Du Tertre (in Sloane)	French	Antilles	*Agave* or *Furcraea* sp.
Pite (2)	Do.	Do.	Do.	**Tillandsia**, sp.
Pite d'Haiti	Fasio (in Journ. d' Agric. Trop. 1904, No. 41 p. 343)	French	France, Algeria, &c.	**Furcraea**, sp.
Piteira	Martius	Portuguese	Portugal and Brazil	*Agave americana*
Pitha Kalabanda	Balfour (Cyclopædia)	Tamil	S. India	*Agave vivipara* Linn.
Pitha Kalabuntha	Watt E. D.	Do.	Do.	*Agave americana*, Linn.
Pitta	Humboldt, &c.	Spanish	America and West Indian Islands	Ditto

Page	Remarks
125	Mr. Cameron correctly separates the fibre Agave from the true *americana*, but as to the specific name see *Maguey* (4), *Mexican Aloe* (1), *Tequila*.
96	Fibre produced from Agave (D) or (J) or perhaps from a Furcraea.
94-95	*Furcraea*, as Mr. Hemsley has remarked, seems to replace *Agave* in the S. E. of Central America ; in cultivation or as an escape it extends to the Orinoco region, northern Brazil (with Guiana), Cuba and the Antilles. There is much confusion as to species, but all are best suited to a gravelly soil, with a fairly moist climate. See *Cabuja, Mauritius Hemp, Piet*, &c.
98	We should think this covered *Agave* and certain *Bromeliaceae* also.
98	Cf. *Peetha Kalabunda*.
117	Du Tertre speaks of two spineless sorts of *Pite*, of which Sloans thought one might be his *Aloe Yuccae foliis* (*Henequen* of the Islands) but see *Piet* also.
...	An epiphyte belonging to the pineapple family. Cf. *Caraguata* IV.
109	See *Hayti Hemp*.
85	The garden plant seen in Brazil by *Martius* was probably one or other of the varieties of *A. americana* Linn *i.e.*, our (B). He says that he never saw *A. americana* naturalized in S. America.
91, 147	Perhaps Agave (J), but there is great confusion in the vernacular names recorded in most books from S. India.
86, 147	No doubt Agave (D), at least usually. See *Peetha Kalabanda*.
108	See *Pita* (4) above.

Name	Authority	Language	Where used	Scientific determination
Pitta Ahetz	Sloane	Malagasey	Madagascar	*Aloe Yuccae foliis*
Pitte	Lamarck Dict, I. 53	French	France and French colonies	*Agave foetida Linn.*
Pole	...	English	Cosmopolitan	**Agaveae**
Pole plant	Miss. Gdn. Report, 1896	Ditto	America	Ditto
Pooty Mungem	Mad. Exh. Cat. 1857	Canarese	S. India (Mysore)	*Aloe* sp.
Pulque	Humboldt (and others)	Spanish	Central America (Mexico)	*Agave*, spp.
Pulque Agave	Squier, Bates, and others	English	Ditto	*Agave mexicana*

Page	Remarks
98, 113	We have not traced Sloane's authority (possibly an edition of De Flacourt's work), but the plant was perhaps a *Sansevieria*, or the *Bow-string Hemp* identified by *Martius* with 'Sanseviera launginosa,' which appears however to be a *Cordyline* ; see *Bow-string Hemp* (3). On the other hand there is a *Furcraea madagascariensis* of Haworth ; what this was we cannot say, but it is highly improbable that any *Furcraea* should be found in Madagascar unless introduced from America, through the Mauritius possibly, or St Helena.
...	See *Anana de Pite, Bowstring Hemp* (3) and *Laffa*. Identified by Lamarck with a *Furcraea* grown in the *Mauritius*.
80	The scape or flowering stem of *Euagave* and *Furcraea*. When this is thrown up from the trunk the plant is said to ' pole.' Cf. *Hampe, Mast,* and *Maypole*.
81	*Bulbil*, which see.
96	This is given as the source of ropes which were carefully tested at the Arsenals and exhibited in 1857 at Madras. 'Pooty Munjee' is referred to ' *Hibiscus cannabina*.' See also *Cuthala Nar*.
...	The national beverage of *Mexico, (Tequila, Sotol, Mescal,* &c. being distilled spirit), obtained from sundry species of *Euagave* (See *Pulque, Agave* &c.) The name occurs under the form of *Pulco* and *Pulcre* in writers of the early 17th Century, but the origin is obscure, and the statement that *Pulcu* is an Araucanian word for a drink of Peru wants confirmation. 'Pulcro' is a Spanish word, and *Pulco* or *Pulque* may be derived from it. *Pulqueria* is a shop or booth for the sale of *Pulque*, also called *Cantina*.
98, 140, &c.	The true *Agave americana* of Linnaeus, (B) of this Bulletin, is to all intents a purely ornamental species, and its native country is not known at present. It is practically of no economic importance. Whether *Agave Vera Cruz,* Miller, D of this Bulletin *(A. americana* and *A. mexicana* of S. Europe) is one of the Pulque yielding species or not remains doubtful. Recent American authorities mention *A. atrovirens* of Karwinski (which is commonly identified with *A. Salmiana,* Otto) as the chief source in the Apam plain and other centres of the *Pulque* cultivation. This appears to be near our *Agave* (C) sometimes called, but wrongly, ' *A. Jacquiniana*.' ' *Agave mexicana*' is a name to which there is practical objection. *Ignatio Blasquez* (quoted by Dodge) states that there are 33 varieties of *maguey* which grow or are cultivated in the Apam district and 10 Pulque Magueys in Cholula. The brothers Blasquez held that the best species of Pulque Maguey was undescribed, and named it ' *A. Maximileanea,* ' but their distinctions were too fine for either scientific or industrial purposes, apparently.

Name	Authority	Language	Where used	Scientific determination
Quetzalxochtli	Hernandez	Aztec	Central America (Western Mexico)	**Agave Wightii** (of this Bulletin)
Qui	Martius	Maya Indian	Central America (Yucatan, &c)	**Agaveae** spp.
Rail Kattalai	Govt. Botanist Madras	Tamil	S. India (Tanjore)	**Agave Vera Cruz,** Mill.
Railway aloe	Do.	English	S. India	Ditto
Raiz de Zacaton	Kew Sel. Papers Addl. (Ser. II) LXXIX	Spanish	Central America (Mexico)	*Epicampes Macroura,* Bth.
Rakas	Balfour (Cyclopædia I. 51)	Hindustani	S. India	*Agave americana*
Rakashi mattalu.	Mukerji (Desc. Cat. Ind. Prod. Amsterdam, etc.)	Telegu	Do.	*Agave americana*
Rakasi Matta	Govt. Bot. Madras	Telegu?	S. India (Ganjam)	**Agave Vera Cruz,** Mill.

Page	Remarks
91, 102, 147	The drawing and description of this '*Metl*' answer well to our Agave (J), which has not apparently been described from America by any recent author: but this is hardly surprising, as the country about *Mazatlan*—where Hernandez says it was found in warm places—is comparatively little visited. He says others call it 'Metl Pitae' (*i.e.* 'Thread Agave') and that the fibre was prized specially for cloth weaving. It is plainly a *Euagave*, and though the stock of *Theometel* is like that of *A. Wightii* in the sketch, the leaf of this other is much nearer (J)—or the *Tequila* (which see); while the description fits (J) better than either (E) or (F), which moreover seem to affect the '*Templada*,' or plateau, rather than the coast belt or the deep hot canons (*barraneas*) of Jalisco, etc. The second part of the Mexican name seems to be another masquerade of '*Ixtli.*' See also *Yztli.*
145	'Qui' or 'Quil' seems to mean 'herb' or 'grass' in several languages of Central America, and in Yucatan was applied to the fibre yielded by various *Agaves, Furcraeas*, and *Bromeliaceae.* The Maya Quiche country extends from near Vera Cruz to San Salvador taking in both coasts from Guatemala to Honduras, but towards the north is confined to the tropical belt on the Gulf of Mexico. The original Istle of the Mayas was perhaps *Karatas Plumieri*, said to abound in the wild parts of Nicaragua. Tradition bears that the *Henequen* was introduced by a Toltec dynasty from Central Mexico. See also *Yztli, Yacqui, Yashqui*, and (for the Mangue dynasty) *Maguey* (2) and *Magueyes* (1)
86, 147	'Railway Aloe.' See the next.
86, 147	In Madras the 'Railway Aloe' is commonly Agave (D). In Northern India the same species has been used, in parts, for railway fencing, but in the drier tracts Agave (F) has been substituted. Agave E is used also.
...	Often called (see Dodge) simply '*Raiz*,' *i.e.* roots. Cf. *Aloe fibre, Broom root, Brush fibre, Mexican fibre, Mexican Whisk* and *Reju. Raiz* is said to be corrupted into 'rice root.'
...	From the Sanscrit *Rakshasha* = an evil demon. Names of Agave species are frequently compounded with this (See *Bramarakashie*, etc.) Spelled in old reports, etc. as 'Rakus.'
96	See also Rakshi Matalu under *Agave americana* in Watt E.D., and the following.
86, 147	Ditto ditto.

Name	Authority	Language	Where used	Scientific determination
Rakasi Mattalu	Govt. Botanist Madras	Telegu	S. India (Nellore)	**Agave Vera Cruz,** Mill.
Rakas patta	Watt, E.D.	Hindustani	India (Deccan)	*Agave americana*
Rakshasha Bali	Govt. Botanist Madras	Telegu	S. India (Cuddapah)	**Agave Vera Cruz,** Mill.
Ram Bans	R. E. P., Govt. of India	Hindi	Rajputana ? (Jaipore)	**Agave Cantala,** Roxb.
Rambanskeora	Supdt. Govt. Gardens U.P. Agra and Oudh	Do.	N. W. India (Saharanpore, etc)	Ditto
Ramkanta	Watt E.D.	Do.	India	*Agave americana* Linn.
Raspador	Coulter	Spanish	America, West Indies, and Pacific Islands	...
Ravana	Ainslie	Canarese	India	*Aloe perfoliata,* Linn.
Ravana Meshid	Buchanan (afterwards Hamilton)	'Karnataka' (*i.e.* Canarese)	S. India (Mysore)	*Agave vivipara*
Reda aonas	Liotard	Guzarati	Western India	*Agave* Sp.
Reju	Imp. Inko Hand-bst. (Ind. Sec.) No. 12	Bengali	India (Calcutta)	*Epicampes macroura* Bth. ?

Page	Remarks
86, 147	See also 'Rakashimatalu' under *Agave americana* in Watt E. D. and the following.
96	Possibly our Agave (D) : 'patta'=leaf in Hindustani:—also spelled Rakis pattah.
86, 147	Cf. the preceding.
87, 147	'Divine (*i.e*, wild) bamboo.'
87, 90	See the preceding and *Banskeora*, applied to (E) as contrasted with (J).
96	Cf. *Rambans* ('Kanta'='thorn' or 'prickly shrub,' etc.)
...	A machine for scutching the leaves of fibre-yielding *Agaveae*. Originally (in Mexico) an iron scoop or spoon for scraping the *Cajete* (which see) of a *Pulque Agave* plant to promote the flow of sap after drawing off the daily storage.
113	Ainslie states that (with the scape presumably) this attains 10—12 feet in S. India.
91, 131, 147	Agave (J)='*A. vivipara*' of Wight, *not* of Linnæus. Ainslie says that Ravana Meshid is Canarese for a true *Aloe*, which produces the drug in India.
...	Evidently a survival from the days of Portuguese ascendancy. *Rede*=net and *aonas*=pineapple. Cf. *Cravata de rede*. Agave fibre is used by fisher folk on the Indian coasts and islands for nets, etc.
...	Imported formerly from México for brush-making. The ordinary supply of 'whisk' seems to come from the N. W. Terai (Moradabad etc.) and to consist of the roots of one or more *Andropogons*. Cf. *Raiz de Zacaton*.

Name	Authority	Language	Where used	Scientific determination
Sabbare	Forskohl Fl. Aeg. Arab.	Arabic	Arabia Felix (Yemen)	*Aloe maculata*
Sabr	Do.	Do.	Asia, Africa, etc.	*Aloe officinalis*
Sacci	Engelmann	Maya Indian	Central America (Yucatan)	*Agave rigida* var., *longifolia.*
Sacqui	Martius	Ditto	Ditto	*Agave* sp.
Saganara	Madras, Exh. Cat., 1855	Telegu	S. India (Masulipatam)	Sansevieria ?
Saganara Matha	Govt. Botanist Madras	Ditto	S. India (Kistna)	Agave Vera Cruz, Mill.
Sagi Matta	Balfour (Cyclopædia)	Telegu	S. India	*Agave americana*
Samato	Balfour (Cyclopædia)	Telegu	S. India	*Fourcroya cantula*
Samba kattalai	Govt. Botanist Madras	Tamil	S. India (Salem)	Agave sp.
San ka Nar	Watt, E. D.	Deccani	S. India (Deccan)	*Agave americana*
Sauga Rope	Madras Exh. Cat. 1857	Telegu	S. India (Guntoor)	*Sanseviera Zeylanica*
Saugoo nara	Do.	Do.	S. India (Vizianagram)	Ditto
Saparra	Martius	Sicilian	Sicily	Ditto
Seaside Aloe	Ainslie Mat. Med. (1826) ii. 169	English	S. India	*Aloe littoralis*, Koenig

Page	Remarks
107	Forskohl distinguishes this from 'Aloe officinalis' to which he attributed the 'Socotra Aloes.' Cf. *Sabr.*
113	Lane and Burton quote certain meanings of the Arabic word which refer to 'patience' or 'endurance,' but these are most likely secondary, and founded on the plant's remarkable vitality (cf. *Sempreviva).* There are many variations, *e.g.*, Sabir, Sibir (Persia), Cebar and Sebar (Spain), Sobr (Palestine), Sabila and Zabila. See also *Acebar, Azeure, Azul,* etc. Sabarra and Seubbara (Africa) are perhaps of independent origin, and have given rise to a number of the names of the naturalized *Agave* of S. Europe (see *Sabbare, Seubbara, Saparra,* etc.)
143, 144	The chief *Euagave* of the Yucatan plantations differs from the kind Dr. Perrine selected for acclimatization in Florida; it is understood to be the *Sacci, Sacqui* or *Sosquil* and near Agave (G.) = *A. sisalana* Perrine. Spelled by Dodge '*Saci,*' but the word is certainly compound, and the second syllable is '*Qui*' (q.v.) This is *not* the 'sisal' of India or the Bahamas, which is '*Yashqui.*'
77	Sent as '*Bowstring Hemp.* Martius seems to have thought that this might be *Marsdenia tenacissima* W. and A. (See *Bowstring creeper*).
86, 147	Cf. the next.
96	Cf. the preceding. Spelled by Brown (Handbook of Agri-Hort. Soc. Gdn. and neighbourhood of Madras, 1866) as Sagi Mutta. Perhaps from 'Sagi' (Malay) = *Metroxylon* sp. (a palm).
130	*Fourcroya Cantula* of Haworth is a misnomer, apparently, for *Agave Cantala,* Roxb.
147	This is very nearly allied to Agave (J), but seems a lighter and smaller plant altogether, with the leaves narrower. The variegated garden kind hitherto referred as a variety to Agave (J) may be the same as Mr. Barber's plant, which comes from Tinevelly, etc. Cf. *Seemai Kattalai* and *Seeppu Kattalai* also.
96	'San' is primarily *Crotalaria* or *Hibiscus* fibre. Cf. *San ka nar* and *Belati pat.*
77, 77	Cf. *Saganara matha,* which is Agave D. Roxburgh does not mention this set of names apparently. 'Sauga' suggests the Malay sago palm, to which Agave might be likened, but hardly *Sansevieria.* The Guntoor exhibit was rope made from '*Sauga*' apparently.
107	From '*Sabarre*' or '*Seubbara*' which is applied to *Agave* spp., naturalized in N. Africa (probably to *Aloe* originally).
113	Cf. *Small Aloe.*

Name	Authority	Language	Where used	Scientific determination
Seema Kathalai	Govt. Botanist Madras	Tamil	S. India (S. Arcot)	**Agave Wightii** (of this Bulletin)
Seema Kattalai	Do.	Do.	S. India (Tanjore)	Ditto
Seemai Kattalai	Do.	Do.	S. India (Tinnevelly)	**Agave** sp.
Seemay cattalay	Mad. Exh. Cat. 1857	Tamil	S. India (Chingleput)	*Fourcroya gigantea*
Seemay Kathalay	Brown and Wood	Tamil?	S. India	*Furcraea gigantea*, Vent.
Seemay Kuttalay	Madras Exh. Cat. 1855	Tamil	S. India (Madura)	**Furcraea** sp.
Seeppu Kattalai	Govt. Botanist Madras	Tamil	S. India (Tanjore)	**Agave Vera Cruz**, Mill.
Sempreviva	Danielli	Italian	Italy	*Agave americana* Linn.
Seubbara	Balfour (and others)	Arabic	N. Africa	*Agave americana*
Short aloes	Mad. Exh. Cat. 1855	English	S. India (Mysore)	*Agave americana*
Silk Grass (1)	Spon	English	England and America	*Nidularium Karatas*

Page	Remarks
91, 147	Cf. *Samba Kattalai* and the following.
91, 147	Ditto ditto.
87	See *Samba Kattalai.*
94, 95	Also spelled 'Cuttalay.' Cf. *Seemai Kattalai.*
94, 95	Cf. the preceding.
94, 95	'The small Aloe', and should therefore be a true *Aloe*, but see the preceding.
...	Cf. also the preceding.
114	The true *Aloe*,—and hence the *Agave*,—was called 'Sempervivum' and 'Aizoon' in Mediaeval Europe with reference to their tenacity of life, but the connected traditions (see *Sabr*) are of Syrian (or Nubian) origin.
96	See *Sabbare*, *Sabr*, and *Saparra.*
118	The scientific names of this and *Long Aloe* seem to have been transposed (See *Long Aloe*).
93-98	Spon's reference is correct for the coast from the Gulf of Campeachy to near Vera Cruz, where a 'fine' fibre seems to be obtained from a Bromeliad which is probably the species quoted = *Karatas Plumieri* of E. Morren, and perhaps the '*Bromelia Karatis*' of which Squier gives an illustration. See *Ahana de pite*, *Bromelia Pite*, *Caraguata* (1) *Caraguata* V, *Caroata*, *Curratow*, *Gravata*, *Grawatha*, *Henequen* (1), *Istle* (1) and (2), *Ixtle* (1) and (2), *Ixtli* (1) *Karaota*, *Mexican Fibre* (3), *Pinuella*, *Pita* (3), *Pita Bromelia*, and *Pita de Zapateros*, also the following.

NAME	Authority	Language	Where used	Scientific determination
SILK GRASS (2)	Temple (in Journal Soc. of Arts, V. 125)	English	Central America (British Honduras)	*Bromelia sylvestris*
SILK GRASS (3)	Dodge	Ditto	England and America	*Bromeliaceae and Agaveae*
SILK GRASS (4)	Kew Sel. Papers (Addl. Ser. II) LXV	Ditto	Jamaica	*Furcraea cubensis, Haw.*
SILK OF GRASS	Hariot (in Sloane)	Ditto	Central America	*Aloe Yuccae foliis*
SIMAI KATHALAI	Mukerji	Tamil ?	S. India	*Furcraea gigantea*
SIME KATTALAY	Balfour (Cyclopædia)	Telegu	Ditto	*Fourcroya Cantula Haw.* [formerly *Agave Cantula* Roxb.]
SIME KATTALE	Liotard	Canarese	S. India (Mysore)	*Agave vivipara*
SIROOGHOO KUTTALAY	Ainslie, Mat, Med. 1826, ii—169	Tamil	S. India	*Aloe littoralis*, Koenig
SISAL	...	...	...	...

Page	Remarks
98	From Temple's description this name, given by the denizens of British Honduras to the '*Istle*' or '*Pita Bromelia*' (which see), probably indicated *Karatas Plumieri*, E. Morren: for fuller references see the preceding.
98	"Some of the species of fibres that have been called Silk grass . . . . . are *Ananas sativa*, *Karatas Plumieri*, *Bromelia sylvestris*, *Furcræa Cubensis*, and other similar forms, while the name has even been applied to the fibre of some of the Agaves. Its use, therefore, without the botanical name of the species can only add to the confusion which already exists."
94, 95, 98, 128	Sir Daniel Morris thinks that *Furcraea cubensis* may also be a source of silk grass fibre in Yucatan (cf. *Sisal Hemp* and *Cajun*).
Do.	See *Grass Silk*, etc.
94, 95	Cf. *Seemay Kathalay* above.
94, 95	Probably Mauritius Hemp, wrongly identified with Agave (E) in consequence of Haworth's having transferred Roxburgh's plant from *Agave* to *Furcraea*, erroneously.
Do.	As the fibre is said to be very long, fine, and white, and the English name is given as 'Green aloe,' the fibre was no doubt Mauritius Hemp, and from a *Furcraea*. See *Green Aloes* also.
...	Cf. *Kattali*, &c., and see also *Kuttalay*.
...	A port on the coast of Yucatan, formerly the chief outlet for the fibre of the Merida district. The export trade is said to have now shifted to Progreso.

Name	Authority	Language	Where used	Scientific determination
Sisal Hemp	Martius (Beitrag etc. p. 39), also Kew Sel. Papers (Addl. Ser. II) XLII and XLIX	English	Cosmopolitan	**Agave longifolia,** Engelmann **Agave sisalana,** Perrine, etc.
Small Aloe	Ainslie Mat Med. (1826) ii—169	English	S. India	*Aloe littoralis* Koenig

Page	Remarks
146, also 89, 143, 147	The fibre long exported from the coast of Yucatan was mainly derived from a *Euagave* to which the name of *Sacqui* ('Qui' being 'fibre') was given by the *Mayas*, a civilized nation (see Keane in Stanford's Compendium, '*Central America*') who were once the ruling power from the Nicaragua Isthmus to the Vera Cruz coast-belt of Mexico. Other fibres seem to have been exported also, on their own merits, or mixed with the fibre of the *Sacqui*, which is still grown in plantations on a large scale. One may have been from a *Furcraea*, and another is called 'Istle,' but whether this 'Istle' was the same as the *Pita Bromelia* or *Silk Grass* of Honduras is uncertain; through mixing of the fibres, or confusion over local names Yucatan fibre has been called 'Silk grass' and 'Istle,' and a *Euagave* has been named '*Agave Ixtli*' on the assumption that it is the source of 'Yucatan Istle fibre.' In 1838 Dr. Perrine, then U. S. Consul at Campeachy, took several kinds of *Euagave* to the coast of *Florida*, and started plantations, which were ruined by a Seminole incursion, and the plants have run wild; but the species which he judged best adapted for the American plantations was Agave (G) of this Bulletin, *i.e.*, *Agave sisalana*, Perrine, which has since spread to the Bahamas, and has been introduced into British India, South and East Africa, Australia, the Pacific Islands, and the Philippines. *Engelmann* in a valuable account of this group of Agaves has treated the *Sacqui* or Sosquil as well as the *Yashqui* [which is (G) or Perrine's Agave] as 'varieties' of a supposed wild plant, which he further identified with a species described by Miller under the name of *Agave rigida*. We do not know what Miller's species actually was, but it certainly was *not* Perrine's fibre Agave. There is only one *Sisal* Agave in India, which has often prickles on the edges of the leaf, sometimes many, sometimes a few only; the best sort is entirely free of margin prickles, but is liable (in this respect) to vary. The 'longifolia' of Engelmann, which is the '*Sacqui*' chiefly grown in Yucatan, is *not* known so far in India, and is a different plant from the *Yashqui* (which is Perrine's species and the 'Sisal' of India). It is doubtful if either the *Sacqui* or the *Yashqui* exists anywhere except in cultivation. Both 'Yashqui' (A. *sisalana*, Perrine) and 'Sacqui' (A. *longifolia*, Engelmann) are grown in Yucatan, but *A. sisalana*, Perrine is the plant that has been introduced in India, and in the Bahamas. '*Bahamas Hemp*' has been attributed to '*Agave rigida* var. *elongata*', on the supposition apparently that the *Sacqui* had been so described by Engelmann; it is true that Engelmann supposed that the *Sacqui* might be 'A. elongata' of Jacobi, but his *own* name for '*Sacqui*' was 'var. *longifolia*.' We distinguish these plants thus: *Sacqui*, *i.e.*, the chief 'Sisal' of Yucatan = A. *longifolia*, Engelmann; *Yashqui*, *i.e.*, the Bahamas Hemp, and E. Indian 'Sisal' = A. *sisalana*, Perrine. See also *Henequen* (3), etc.
...	As compared with *Agave* and *Furcraea* species called '*Large Aloe*' or '*Great Aloe*.' See *Small Aloe*, and *Seaside Aloe* also.

Name	Authority	Language	Where used	Scientific determination
Smokva arapska	Visiani	Sclavonic	S. E. Europe (Dalmatia)	*Agave americana* Linn.
Soap Agave	Smith (Dict. Ec. Plants)	English	Central America (Mexico)	*Agave Saponaria*
Sacqui	Martius	Maya Indian	Central America (Yucatan)	*Agave rigida*
Soduesun	Liotard	Hindi	Central and N. W. India	...
Sotol	Rose	Spanish ?	Central America (Mexico)	*Dasylirion* sp.
Spanish Aloe	Guilfoyle	English	Australia ?	*Agave americana* Linn.
Spanish bayonet	Dodge	Do.	N. America	*Yucca spp.*
Spatone	Danielli	Italian	Italy	*Agave americana* Linn.
Sucker	...	English	Cosmopolitan	...
Sun ka nar	Ainslie	Deccani	Central & S. India	Agave sp.
Suvaru	Govt. Botanist Madras	Tamil	S. India (Tinnevelly)	...
Suvaru Kattali	Do.	Canarese	S. India (Bellary)	Agave Vera Cruz, Mill.

Page	Remarks
107	The species is believed to be Agave (D) and to have been brought to the Adriatic littoral from Sicily or Calabria where the true *Aloe* was introduced from N. Africa by the Saracens, and named from the Arabic. When the *Agave* came to S. Europe from America, sundry local names of the true *Aloe* were extended to it. See *Saparra*, etc.
97	*Agave Saponaria* of Lindley is identified with *A. brachystachys*, Cav. of the *Littaea* group, and the reference is doubtless to the *Amole* Agaves (see *Amole* &c.) Several of the West Indian *Euagaves*, however, are much used for scouring purposes (see *Keratto* also).
146	A spelling of *Sacqui* = *A. longifolia*, Engelmann.
...	Said to have furnished Jail factories with stock for paper-making in Dehra Dun and Moradabad (Agra Province) and to be called in Rohilkhand '*Baskitri*' (which see), also to grow wild in Lliatpur (towards Central India). *Sukhdarsan* is the usual name of one or more species of *Crinum*, but none of the Indian species of *Crinum* or *Pancratium* is known to yield fibre, though they are nearly allied to the *Agaveae*. *Crinum asiaticum* var. *toxicaria*, Herb. is called (See Watt, E.D.) in Bengal *Bara Kanur*, while *C. latifolium Linn.* (perhaps wild towards Central India) is (Bengal Plants p. 1061) the true *Sukhdarshan*. The names *Kanwar* and *Kanur* have been confused possibly (see *Bara Kanwar*). Fibre from Euagaves has been largely used at different times for paper-making throughout India. *Baskitri* was perhaps Agave (E) or an allied species, and the reference to *Sudarsan* may be due to a mistake or to some very local application, of the name, which may not after all be the same as *Sukhdarshan*. We do not know of either being applied to *Agave* in N. W. India.
98	A kind of spirit formerly supposed to be distilled from the juice of '*Agave americana*,' but now ascertained to be got from *Dasylirion* which does not belong to the *Agaveæ*.
...	Cf. *Mexican aloe*, etc.
78	See *Dagger Plant* also.
96	From the resemblance of the leaves to swords. Danielli gives several variations, *e.g.* Spata, Spadu, Spatona, Spatola, etc.
...	See *Offset*.
95	See *San ka Nar* also, but the name seems very doubtful.
147 (footnote)	This is a doubtful plant, probably the same as the *Sambakattalai* from Salem, and perhaps a form of (J), *i.e.*, *Agave Wightii*.
87, 147	This is a hedge plant; the preceding looks like a dwarf kind of a quite different species (J).

NAME	Authority	Language	Where used	Scientific determination
TABAGO SILK GRASS	Dodge	English	America	*Furcraea cubensis*
TACORI	J. Bauhin and Sloane	[Tupi Indian]	S. America	*Aloe Yuccae folii* (Sloane)
TALE NARU	Liotard	Canarese	S. India (Mysore)	*Pandanus odoratissimus*
TAPEMETE	Rose	Mexican	Central America (Mexico)	*Agave vivipara*
TAMPICO	...	...	...	...
TAMPICO FIBRE	Rose	English	America	*Agave* spp.
TEQUILA (1)	Rose (and others)	Spanish	Central America (Mexico)	*Agave* sp.

Page	Remarks
34, 35	Cf. *Silk Grass* (3) and (4) and *Nequamell* (2). Also spelled 'Tobago'. De Laet's drawing of the plant he called *Nequamell* (which see) was made in Tobago.
	The older writers seem to have connected this in some way with the *Agaveae*, but it was doubtless the *Tagoara* fibre now ascribed to *Guadua Tagoara*, Kunth (of the Bamboo family).
...	'Tais' is properly a palm, but often applied to species of *Pandanus* in S. India.
	Mr. Rose is referring doubtless to *Agave vivipara*, Baker, of which the description answers *A. vivipara* of Wight, *i.e.* (J) of this Bulletin. He observed it in Jalisco and Zacatecas on the sides of hot ravines, where thread is got from it for household uses. So far as we can judge from his description, the 'Tapemete' is not the plant called *A. vivipara* by Buchanan, and figured by Wight, though it may be very near it. It is probably the *Tepemexcalli* of Hernandez.
	A port bordering on the State of Vera Cruz (in the Mexican Republic) from which fibre collected in *Tula*, *Zacatecas* and other upland tracts is exported for brush-making.
..	This has often been regarded as co-extensive with 'Istle' and obtained in great part from '*Agave heteracantha*,' but there is considerable doubt as to what '*Agave heteracantha*' may be, and it is now certain that there are a number of species which contribute to the supply of 'Brush fibre' through the ports on the Gulf of Mexico, of which *Tampico* as regards this branch of trade is the principal. It is also clear that *Ixtle* or Istle is applied in different parts of Central America to very different fibres: the Istle of British Honduras being derived from a Bromeliad and not from an Agave at all. Also sometimes called 'Tampico Hemp' (unless this is really something quite different).
36	A liquor (spirit) made from the sap of an *Agave*, chiefly in the States lying westwards from the capital (*Jalisco*, etc.). Mr. Rose says that the leaf is very narrow, and that it may be the same as *Huila* (which see), but in any case is not *A. americana*. If *Huila* be the same then it yields fibre also.

Name	Authority	Language	Where used	Scientfic determination
Teq̇uila (2)	Nelson	Mexican	Central America (Mexico)	**Agave** sp.
Thalay nar	Mad. Exh. Cat. 1857	Canarese	S. India (Madura)	*Pandanus odoratissimus*
Thembu nanut	Liotard	Burmese	Burma (Mergui)	*Agave americana*
Theometel	Hernandez	Aztec	Central America (Mexico)	**Agave** sp.
Toccon	J. Bauhin	Brazilian	S. America	...
Tol	Martius	French	Antilles	*Furcræa cubensis*
Toucon	Lery (in Sloane)	Do.	Do.	*Aloe Yuccae foliis*
Tow	...	...	...	...
Trap tree	Martius	English	Malaya (Singapore)	*Artocarpus* sp.

Page	Remarks
88, 89, 98, 125, 147	Mr. Nelson's *Tequila* seems to be the same as the preceding, excluding possibly the suggested identity with 'Huila.' It is grown in large plantations in the State of Jalisco (capital *Tequila*). Mr. Nelson's figure (Plate XXXV), which we had not seen when Parts I and II were written, shows an *Euagave*, of the Sisalana group, apparently, very closely resembling our Agaves (E) and (F), but especially the latter, which is Mr. Gamble's "*mexicana*." If, as seems not unlikely, certain of the species naturalized in India came originally from the Tequila and Zapotlan country, then possibly F = '*A. mexicana*' of Gamble (and probably T. Moore), may be = *Tequila*; J = *A. Wightii* of this Bulletin (A. vivipara of Wight) = Bastard Tequila; E = *A. Cantala Roxb.* = A. vivipara of Rose of which the description is not that of Wight's 'vivipara,' but would fit our (E) or Baker's A. *laxa*. See the preceding, also *Bastard Tequila*, and *Huila*.
...	Cf. *Tale Nar*. Spelled *Thaulay Nar* also. Pandanus is often spoken of as a fibre plant, but the commonest use seems to be by cutting strips from the leaf for mat-making, etc., rather than by extraction of the actual fibre.
96	Nanut = Pine apple ?
125, 127	Zuccagui refers Hernandez' plant to A. *Theometel*, Zuccagni. The trunk in Hernandez' representation is suggestive of Agave (J), but the leaves are quite different. Theometel extract was in great repute as an anti-periodic drug. It may not be an *Euagave*, and is seemingly unknown in India.
...	See *Toucon*.
...	See *Bois de Meche*, etc.
...	Sloane cites these with a query under the title quoted, which includes *Henequen*, etc. It was probably the fibre attributed by Squier to the *Ticu palm* of 'marshy grounds of the Orinoco' and the 'Tecum' as to which there is great confusion, but the different fibres under these names are got from different species of palm and not from any of the *Agaveae*.
...	Short curled or interlaced fibres, from certain *Agaveæ*, *Yuccas*, and *Bromeliceae*, as distinguished from the long staple of the best species of *Furcraea* and *Euagave* (*Sansevieria* also).
...	Cf. *Kantal* or *Kathal*. This is probably not the Jack fruit however, but the *Getah Tarap* = *A. Kunstleri*, King of which Ridley (Flora of Singapore) says the bast is used for cordage and cloth-weaving. Mr. Ridley elsewhere says that locally fibre is got from an *Agave* but we do not know what the species may be.

Name	Authority	Language	Where used	Scientific determination
Venetian whisk	Kew Sel. Papers (Addl. Series II) LXXIX and LXXX	English	Europe, etc.	*Chrysopogon Gryllus*
Vera Cruz	...	...	...	...
Vera Cruz Aloe	Moon (Ceylon Catalogue)	English	Ceylon	Agave Vera Cruz, Mill.
White fibre	...	English	England, India etc.	Agave and Furcræa also Bromeliaceæ
Wilayati ananas	...	...	...	...
Wilayati Kantala	Stewart, (Punjab Plants, p. 232)	Hindustani	N. W. India (Punjab)	*Agave Americana* L.
Wild Aloe	Liotard	English	Beluchistan	Nannorhops Ritchieana, H. Wendl.
Wild Aloe fibre	Mad. Exh. Cat., 1857	Do.	S. India (Bellary)	*Agave* sp.
Wild Aloes	Mad. Exh. Cat., 1855	Do.	S. India (Coimbatore)	Do.

Page	Remarks
...	See *Broom root*, *Brush fibre* (1 and 2), *Mexican Whisk*, etc.
...	A town and harbour on the Gulf of Mexico (State of Vera Cruz), which was and still is the chief seaport of the central parts of Mexico. It lies in the warm coast strip below the plateaux and the Cordilleras, but as the products of Mexico found their way largely by this route to Europe, plants have been attributed to the Vera Cruz neighbourhood which are not found there or even very near it.
131	Agave (D) most likely. We have seen no Ceylon specimens. The name has often been used in Europe also, but it is not always easy to say which species may have been intended. The true plant was first described by *Miller*, afterwards in German (very well so far as the leaves go) by Gmelin (*Onomat.* Frankfort and Leipzig 1772, p. 202) under the name of *A. Vera Crux.* (See also Dietrich, *Nachträge.* I, 135 where Miller's name is given correctly.)
...	A term sometimes used for fibres from the *Agaveae* (and probably also from *Bromeliaceae*, e.g., the *Pita Bromelia*) as distinguished from the Manila Hemp (see *Abaca*) obtained from *Musa textilis.* In Yucatan, on the other hand, the *Euagave* fibres were divided by the natives into 'white' and 'green,' which had reference to the colour of the pulp before heckling apparently.
...	See *Bilati ananas*.
95	This was doubtless on the supposition that Agave (J), which is self-maintaining in parts of the Punjab, was a native of India as compared with other kinds of *Agave* (notably the garden *A. americana* Linn.) which were known in cultivation. Other species than (J) are now, however, to be found in the Punjab in hedges.
...	See also *Pesh* and *Aloe*.
96	No doubt (J) or (D). Sent in 1855 from *Nellore* without clue to the plant. *Aloe perfoliata*, a true aloe, is said to be abundant and to grow to a great size in Mysore, etc., so that fibre from this has probably been frequently confounded with that from *Agaveae.* Cf. *Hedge Aloe* (1) and (2).
Do.	Ditto Ditto Ditto.

NAME	Authority	Language	Where used	Scientific determination
YASHQUI	Engelmann	Maya Indian	Central America (Yucatan)	**Agave sisalana**, Perrine
YAXCHE	Dodge	Aztec	Central America (Mexico)	*Bombax ceiba*
YAXCI	Miss. Gdn. Rept. 1896	Maya Indian	Central America (Yucatan)	**Agave sisalana**, Perrine
YANUGA CALABUNDA FIBRE	Mad. Exh. cat., 1857	Telegu	S. India (Kurnool)	*Aloe perfoliata*
YENUGA KALABANDA	Govt. Botanist Madras	Do.	S. India (Gantur, Kurnool, Nellore)	**Agave Vera Cruz**, Mill.
YENUGA KALABONDA	Do.	Do.	S. India (Cuddapah)	Ditto
YENUGA KALAMANDA	J. A. C. Boswell (Nellore Manual)	Do.	S. India (Nellore)	**Agave** sp.
YSTLE	Miss. Gdn. Rept. 1896	Mexican	Central America (Arizona Texas and southwards)	*Agave Lechuguilla*, Torrey and allied species
YUCAY	Mad. Exh. cat. 1855	Canarese?	S. India (Mysore)	*Aristolochia indica*
YUCCADA FIBRE	Mad. Exh. Cat. 1857	Aztec	Central India	...

Page	Remarks
...	Agave (G) See *Sisal hemp*. Spelled by Martius *Yaxqui*, and by others *Yaxci*, *Yaxqui* &c.
...	A cotton tree: the down from the capsules is used for stuffing pillows &c.
...	See *Yashqui*.
...	Cf. the following.
...	Cf. the following and the preceding, also *Enugakalabanda*, etc.
...	Ditto ditto ditto.
...	Probably Agave (D) as above.
...	Cf. *Istle*, &c.
...	This is given as 'Yucay, white' and is followed by 'Yuccay, red' without any clue to the origin of the latter. There is evidently some mistake. None of the Indian *Aristolochias* are known to have yielded fibre, while *Yekka*, *Yekkada*, *Yokada*, &c., are names of the well known '*Yercum*' (a *Calotropis*). See the next also.
...	'*Yuccada fibre*' sent from Hyderabad was placed among 'unclassified barks' in 1857, but '*Yuccada Naru*' from Bangalore was referred to *Yucca gloriosa*. *Yakkada Naru* is given in the Mysore list of paper fibres (in Liotard '*Yekkada naru*'). True *Yucca* and *Agave* have been a good deal confused in S. India.

Name	Authority	Language	Where used	Scientific determination
Yztli	Hernandez	Aztec	Central America	...
Zabbara	Danielli	Italian (Provincial)	Italy	*Agave americana*, Linn.
Zabbara di ghai	Do.	Do.	Do.	Ditto
Zamarra	Do.	Do.	Do. (Calabria)	Ditto
Zambarone	Do.	Sicilian	Sicily	Ditto
Zaparra	Do.	Italian (provincial)	Italy	Ditto
Zubbub	Do.	Arabic	N. Africa	...
Zugo de Coc oyza	Humboldt (Ex Miss. Gdn. Rept. 1896)	Spanish	Central America	*Agave americana*, Linn.

Page	Remarks
...	The mineral obsidian, from which, as Hernandez recounts (Ant. Rech, p. 339) the native Mexicans, before the use of metals was discovered, made their swords, daggers, knives, arrow-heads and spear blades. Even after the reduction of the country by the Spaniards, obsidian knives only were used to cut the leaves of the 'Octli' ('Pulque') yielding *Agaves* (Recchi has made nonsense of the text s. v. 'Metl seu Maguei' by omitting a letter), and the name of *Yztli*, *Ixtle* or *Istle* was no doubt taken from the likeness of the ensiform leaf to the 'ill-omened and atrocious blades' with which the Aztec champions would 'divide an enemy at one blow into two pieces.'
96	i.e. *Agave Vera Cruz*, Miller, the naturalized species in S. Europe, from the N. African *Seubbare* or *Sabarre*, or from *Sabr*, the true aloe. See *Sabr*, *Seubbare* etc.
96	See the preceding.
109	See the next.
109	Danielli derives this from 'Zaubar' which he says means threads (of wool) in Arabic, but the word he means is perhaps '*Zaubar*.' These variants may be from *Musambra*, the Arabic name for the drug as distinguished from the plant, which has been taken into several languages, in India particularly.
96	See *Zabbara*, *Saparra*.
96, 109	Martius gives this as *Zaubar* which is no doubt = *Seubbare*. It is quite possible that there may be such words as 'Zaubar' or 'Zambar' in the N. African dialects of Arabic, and that these are applied to the *Agaves* naturalized along the coast of *Algeria*, etc.; but the Saracen ascendency in Sicily and S. Italy had ceased before the *Agaves* reached either Europe or Africa, and the names of the *Saparra* and *Zambarone* series were given to the true *Aloe* in the first instance presumably.
96	The juice of young plants is said to be used locally as a caustic in surgery. Writers on the West Indies mention the juice of different *Agaveae* as a detergent for wounds, etc. The juice from cut leaves of the *Sisal Euagave*, also (D), is more or less acrid, if they are much handled. That of (*Agave* (H) is said to be uniformly harmless.

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HELIANTHUS ANNUUS.

(SUNFLOWER.)

[*Dictionary of Economic Products, Vol. IV.*, H. 74-87.]

The Sunflower in India.

By David Hooper, F.C.S., F.L.S.

INTRODUCTION.

Numerous enquiries have been addressed to the Reporter on Economic Products during the past ten years in regard to the growth of sunflowers for economical purposes, the properties of the seed, and the manufacture of the oil. The enquirers were usually planters who desired information on the methods of cultivation and outturn in India, while the others were merchants desirous of finding a market for the seed and oil. The present *Agricultural Ledger* reviews the experiments in the growth of the sunflower in this country, and gives the commercial importance and uses of the products of this plant in other lands. If it does not stimulate the industry, it will at any rate serve as a guide to those who contemplate undertaking further experiments in the cultivation.

The sunflower is a native of Mexico, known as *tournesol* in France, *podsolnetchnik* in Russia, and *suriya phul* in India.

The Industry in Europe.

The sunflower industry first began to assume importance in Russia in 1830, and since that time has steadily increased. In that country it is most extensively grown in Kielce and Podolia, and the district of Birutch in Voronezh. In Italy its cultivation is confined to the neighbourhood of Pieve and Conegliano in Venetia. It has also been introduced into Hungary, Germany, and France. The production of seed in Europe a few years ago was estimated at 228,000,000 pounds from an area of 216,000 acres, or 1,325 pounds to the acre. In Tartary and China it is said to be cultivated in immense quantities, but no statistics are available.

INTRODUCTION.

The seed is the most useful portion of the plant, and this is commonly eaten raw or cooked or used for the extraction of oil. The oil-cake left after expression forms a valuable cattle food and a condition powder for horses. The leaves and the stalk have distinct food values, and when reduced to a sufficient state of fineness possess nutritive properties of a high order.

The sunflower stem has rather strong bast fibres, and the plant has often been suggested as a source of cellulose for paper mills. The amount of cellulose even in Indian-grown plants is comparatively high. The fibre is too weak and brittle, however, to be of value for cordage or textile purposes, and perhaps its highest value is obtained in its use for fuel, the ash being rich in potash.

Cultivation.

CULTIVATION in the United States.

The method of cultivating sunflowers for commercial purposes is best described by Dr. H. W. Wiley from the results of their growth in the United States. "As a rule the soils which are best suited for the growth of Indian corn (maize) produce the best crop of sunflowers. If the soil is not naturally fertile, liberal fertilisation must be practised in order to secure large crops. The character of the fertilisation depends upon the nature of the soil and the deficiencies of plant foods therein. The kind of fertilisation necessary to produce a good crop of maize will be found suitable for the sunflower. The soil should be prepared by careful ploughing, and the surface of the ploughed soil should be reduced to good tilth by the use of the harrow. Sunflowers are best planted by a drill in rows from 3 to $3\frac{1}{2}$ feet apart. In order to secure a good stand the seeds may be placed by the drill 2 or 3 inches apart; but should they all grow, at least half of them should be cut out when the plants are thinned. The seeds should be planted deep enough to secure abundant moisture to germinate them; from 2 to 3 inches in depth when the soil is not too heavy will be found the best. With heavy, stiff soils, which are likely to become very hard on the surface after heavy rains, it is better not to plant the seeds so deep. The seeds should be planted as early as possible in the spring, as they endure very well a slight degree of cold. After the plants are well formed they should be thinned so as to stand at a distance of from 12 to 18 inches in the row. The cultivation should be of the ordinary kind, mostly superficial, and sufficient to prevent the weeds from growing and preserve the moisture during periods of drought. When the production of seed is sought, the best results are secured by limiting the number of seed heads on each plant to a very few. The superfluous heads when formed should be removed. No special directions need be given for the cultivation, since it is so much like maize as to be practically the same."

Russia.

In Russia the seed is drilled into lines 18 inches apart, and the plants are thinned out to 30 inches apart in the rows, thus giving

about 11,000 plants to the acre. The quantity of seed required for an acre is five pounds. CULTIVATION.

Experimental culture in France gave a return of 1,778 pounds of seeds yielding 16 per cent. of oil and 80 per cent. of cake from an acre; but the product varies considerably according to soil, climate and cultivation, and the average may be roundly stated at 50 bushels or 1,150 pounds of seed from an acre and one gallon of oil from one bushel of seed. In America the yield of seed is from 800 to 1,500 pounds per acre.

The sunflower in its cultural requirements and its products is related to another oil seed plant, grown also for its dye, in this country, namely the safflower (**Carthamus tinctorius**). A European writer has recommended safflower as a suitable plant to replace sunflower in Russia where the latter is subjected to insect ravages. Safflower survives in arid lands, shows a relative insensibility to frost, and is immune to insects and other parasites which decimate sunflowers. On the other hand safflower furnishes an oil-cake inferior to sunflower in consistence and taste. At the same time these undesirable matters residing as they do in the husk may be removed by decortication before the grains are pressed. The leaves of the safflower plant are extremely prickly, which make them difficult to handle, but it is possible to obtain by selection a variety which has no spines. Sunflower versus Safflower.

The heads should be harvested before the seeds are quite ripe to avoid shattering and loss After drying, the seeds can be thrashed out or beaten with a flail, or, where large quantities are grown, the heads may be placed in a machine consisting of a rotating disc studded with iron nails. The seeds should be stored in bags in a dry place to prevent mould. Harvesting.

The Seeds.

There are three principal varieties now cultivated in Russia, known by the shape and size of the fruits (achenes), conventionally called seeds, one with large white seeds which are said to yield the largest amount of oil; one with small black seeds which are sweeter and regarded as best for eating; and an intermediate form with striped seeds, used both for eating and the production of oil. The Seed. Varieties

From experiments made in America it was found that the total weight of the seed is about equally divided between kernel and shell, a series of weighings giving from 41 to 60 parts of kernel in 100 of the seed. Inasmuch as the shell is rather an absorbent material it is important, in the expression of the oil, that it should be removed so as to avoid the absorption which otherwise would take place; 100 seeds of the striped Russian variety weighed 6·99 grams, 100 seeds of the ordinary black variety weighed 10·60 grams.

In Indian-grown plants, 100 seeds from Coimbatore weighed 6·57 grams and 100 seeds from Behar weighed 10 grams.

SEEDS. Dr. Voelcker found the Kashmir seed to contain 45 parts of kernel and 55 parts of husk. The writer calculated the percentage of kernel in Behar seeds as 53·16, and in the Coimbatore seeds 44·68. The Indian-grown seeds, therefore, compare favourably with those produced in America and Europe.

Uses of the Seeds.

Uses. These are the most valuable part of the plant on account of their edible kernels and the superior quality of the oil prepared from them. In Russia the seeds are used largely for local consumption. They are sold by the farmer at 4 to 6 shillings per pound and are salted by purchasers, who retail them at 12 shillings per pound, at every street corner in the provincial cities. Sometimes they are roasted like coffee beans and are sold in large quantities at fairs, on feast days and holy days, under the name of "Semotchky." In some seasons the streets of St. Petersburg are littered with the empty husks. Sunflower seeds in Russia are, therefore, eaten as food, as are salted peas in Burma, monkey-nuts in India, and chestnuts in England.

Eaten raw and cooked.

For birds and poultry. Birds of all kinds thrive upon them, and they are specially employed in feeding caged birds and in fattening fowls for the table, and the diet has been said to increase their laying powers. In America the seeds are at present employed in feeding poultry and to some extent mixed with other fodder as a cattle food.

Cattle food. The oil-cake left after the expression of the oil forms a valuable cattle food, being superior in this respect to maize or linseed cake, while it is also said to act as a natural "condition powder" for horses owing to its easy digestibility and its great nutritive property. Sheep, pigs, rabbits and pigeons also fatten rapidly on the oil-cake.

Trade in oil-cake. As an instance of the magnitude of the industry, the production of sunflower seed oil-cake in the Northern Caucasus during the year 1906 was estimated to be from 50,000 to 60,000 tons. The price of the oil-cake was about £6·13 per ton in the spring, advancing to £7·10 during the summer months, and falling back to £6·13 in the autumn. Denmark and South Sweden are the principal buyers.

The Oil.

The oil. Sunflower seed oil in its pure state, on account of its palatability and sweetness, is said to be excellent for table use, for frying fish and other culinary purposes. In Russia it is already in use as an adulterant of, and substitute for, olive or salad oil for all domestic purposes. It may also be used for woollen dressing, lighting, and varnish and soap-making. It has recently been substituted for other fixed oils in the making of margarine.

Uses

OIL.

The oil expressed in 1875 from seeds of plants experimentally cultivated in Bangalore proved a disappointment commercially, for its thinness made it useless for railway trains, it dried too slowly for paints, and, though in the Ordnance Department it was found to serve all requirements, the price was prohibitive.

England.

The prospects of a trade in the seed outside the cultivated lands of Russia are not well established. In 1896 Sir Frederick Abel endeavoured to obtain a reliable opinion on the value of Indian-grown seed from oil-crushers in England, but he found there was no likelihood of the seed competing favourably with other sources either in England or France. One firm of eminence stated that they purchased 100 tons of seed in the London market, but they would not touch it again; the results as regards yield for crushing being very unsatisfactory.

Marseilles.

A sample of the Kashmir seed was also sent to one of the leading seed-crushers in Marseilles, who stated that there would be no sale for the seed in the market as it was too shelly and poor in yield of oil.

Behar.

As an inducement to planters in Behar a market was said to have been arranged in 1901 to purchase oil at the favourable rate of ₹15 (20*s.* 0*d.*) per maund (=82⅔ lbs.), but, as we shall notice, the cultivation in that district has never gone beyond an experimental stage.

Mozambique.

A writer in the "Journal d' Agriculture Tropicale" for January 1907 records the case of a planter in Mozambique who sold a crop of sunflower seed in England in 1905 for fr. 20·5 (17*s.*) for 100 kilos (200 lbs.), a price which fully recompensed him. Later experience, however, showed that the market was limited, and that no purchaser could be found for large quantities of the seed.

Experiments in India.

Garden varieties.

The sunflower (**Helianthus annuus,** *Linn.*) is known as *Suraj mukhi*, *Suriya mukti*, and *Suriya phul*, and grows everywhere in the plains and in the hills and occasionally runs wild. In "Firminger's Manual of Gardening" (fifth edition, 1905) Mr. Cameron says: "This well-known annual thrives well in India; the varieties **grandiflorus-plenissimus** and **californicus** are remarkable, the first for its enormous flowers, the second for its exceedingly double ones.....

The seeds should be sown in July, both on the hills and on the plains. The plant requires no particular treatment, and no care beyond attaching stakes to the tall growing plants to prevent them being blown down and uprooted."

Dr. Cooke in "Flora of Bombay" says the finest variety of the annual species is the **globosus-fistulosus.**

Berhampore.

The first experiment on record made with sunflower oil is recorded in the Agri.-Horticultural Society's Journal, Volume ix,

EXPERIMENTS IN INDIA.

page 366. Mr. Michael Betts of Berhampore in 1855 obtained from 6 cottahs (480 sq. yds.) of land 9½ seers (=19½ lbs.) of seed, which produced 15 chittacks (1·65 pint) of oil and 6 seers (=12½ lbs.) of cake. The latter was greedily eaten by cattle. A report made at the time by Babu Ramgopal Ghose states :—"The oil from the sunflower seed is pretty well known. I do not think it can be produced at a cost which will enable it to compete with other oils of a similar character, and Mr. Betts' statement seems to bear this out. A seer and a half (about three pounds) of seed to a cottah (80 sq. yds.) of land is poor produce, and 10 per cent of oil from the seeds is a still more unsatisfactory result. Unless both the produce of the seed and the percentage of oil can be greatly improved it will not pay to cultivate the sunflower for its oil-seed."

Bangalore.

The experimental cultivation of sunflower was undertaken in Bangalore in 1873 for the purpose of testing its value in the reclamation of marshy land and its efficacy in removing malaria from swampy districts. The experiments proved that the malaria-dispelling virtues attributed to the plant did not exist, though the drainage which had to be employed before it would thrive naturally improved the climate of the district. The cultivation of the sunflower was continued up to the end of 1877 with the view of utilising it profitably in the extraction of the oil and other economic products from its seeds and stems. The reports proved that the cost of production of the oil did not permit of profitable cultivation.

Sibpur.

An experiment with Russian sunflowers was initiated by Mr. N. G. Mukerji in the Experimental Farm, Sibpur, in 1895. In the report of the Farm for 1896-97 the following account is given of the progress of the experiment : "Russian sunflower has grown on a plot having an area of one-tenth of an acre, first as a rain crop, and a second time in the cold weather. The outturn of the plot was 8½ lbs. in the rains, and 47½ lbs. in the cold weather. Birds appeared to be a great enemy of the crop, and a labourer had to keep constantly on the watch to prevent them from alighting on the crop and picking off the seed. Out of the 56 pounds of seed obtained, 50 lbs. were crushed and gave 4½ lbs. or 9 per cent. of oil. The yield of oil compared with that of the usual kinds of Indian oil-seeds was very low. The oil appears, however, to be clear and agreeable to the taste. The experiment of last year has shown that Russian sunflower can be grown with ease in Bengal. Whether its cultivation will pay is extremely problematical."

Coimbatore.

In 1904 the Superintendent, Central Jail, Coimbatore, made the following report on the cultivation of sunflower to the Inspector General of Prisons, Madras :—

"Experiments were made during last year with two varieties of sunflower, one the Giant Russian sunflower, and the other the garden or ordinary variety.

EXPERIMENTS IN INDIA.

The area sown with the Giant Russian seed was 12 acres, while the garden kind was sown in the borders of small gardens and along a water channel 100 feet long, planted 6 inches apart.

	lbs.
The total yield of both varieties as reaped was . .	396
Deduct for husk, light seeds, etc.	273
Balance kernel .	123

Oil obtained 38 lbs. or 30·89 per cent.

Coimbatore.

No special manuring or other care was given to the Russian plants except weeding and watering as requisite, but it was noticed that the plants ran too much into stalk, thus injuring the yield of seed, due no doubt to the richness of soil. For commercial purposes or to raise a paying crop, it seems to me the Russian variety should be sown as a dry crop on moderately good soil with facilities for watering in case of failure of seasonal rains; the season, treatment, etc., for this crop should correspond with the sowing of gingelli (**Sesamum indicum**), which latter is never sown on richly manured soil but on moderately good land irrigated, if possible, or left as a rain-fed crop. The best crops of gingelli are obtained from the stunted and almost leafless plants, while those grown luxuriantly have a very large percentage of empty pods.

One Giant sunflower gave	1,644	seeds.
The ordinary garden one	744	„
Picked and selected, the yield was—		
For the Giant, good seeds	347	
Ordinary garden	326	
And the percentage of good to light seed was—		
For the former	21	„
For the latter	44	

Behar.

In Behar a few experiments were conducted in the cultivation of Russian sunflower in 1900. Mr. T. Cox of Puddumkir, in the Champaran district, went into the matter carefully, employing seed imported from Odessa. Fifteen seers (30 lbs. 13 oz.) of seed were sown in 1 bigha (1,600 sq. yds.) of land in October. Twenty per cent. only germinated, which grew well, yielding plants of 5 feet in height and heads 12 inches in diameter. The crop was harvested in March; but on beating out the seeds it was found that nearly the whole of the seed was hollow and worthless.

Another 15 seers (30 lbs. 13 oz.) were put down in March 1901, and an outturn of $3\frac{1}{2}$ maunds (=288 lbs.) of seed was obtained in November from 2 acres of land planted. The plants did not grow so well as in the previous year, and the heads were only about half the size, though the proportion of empty seeds was small. The crop

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all along had a sickly appearance and many of the young plants were attacked by grasshoppers. Cattle would not eat the leaves and stalk. As a commercial experiment it was considered a failure.

A more recent experiment has been made in Behar by Mr. E. Hamilton Hudson of the Rajpore Indigo Concern. Two years ago some of the best sunflower seed was procured from Messrs. Sutton & Co. and sown in October 1905. The seed was kept from this crop and sown again next year, so that it should be acclimatised. From one-tenth of an acre 72 lbs. of seeds were obtained. The seeds were sound, and the oil expressed from them was of good quality. The cultivation was not costly. The seeds afforded 40 per cent. of husks and 60 per cent. kernels, and from the latter 30 per cent. of oil was expressed. The experiment was not considered a success, as more profitable returns were obtained from mustard and linseed.

Lieutenant J. F. Pogson, an authority on Indian agricultural subjects a generation ago, wrote to the Secretary of the Agri.-Horticultural Society of India in 1875, "I notice that attention is being paid to the oil which may be extracted from the seeds of the sunflower. I look upon this as time and money wasted. Oil and oil-seeds always command a good price, if the seed is sufficiently rich in oil, which the sunflower is not." Lieutenant Pogson, however, notices the leaves, stalks, and seed vessels of the sunflower to be available for conversion into manure; these he found to be superior to leaf manure, but inferior to megass.

We are thus led to conclude that sunflower is a costly crop to grow in India. The leaves and stalks are eaten by cattle, and they make a fairly good manure. The ashes of the stalks form a potash manure. As a garden plant yielding seeds for feeding home poultry, its preparation can be encouraged, but not as a regular oil-seed crop.

Chemical Composition.

Composition of seeds, kernels, and shells.

Dr. J. König gives the average composition of five samples of whole seeds and four of kernels. An analysis of the shells or hulls is added for comparison—

	Seeds.	Kernels.	Shells.
Oil	31·32	44·31	5·17
Albuminoids	13·67	26·28	5·16
Carbohydrates	18·03	16·44	23·92
Fibre	25·35	2·81	54·95
Ash	3·05	3·46	1·78
Water	8·58	6·70	9·02
	100·00	100·00	100·00

CHEMISTRY OF SEED.

Composition. American seeds.

The composition of sunflower seeds grown in the United States is recorded by Dr. H. W. Wiley in Bulletin No. 60, Division of Chemistry, United States Department of Agriculture—

	Wiley.	Babcock.
Oil	27·08	20·52
Albuminoids	14·97	15·88
Carbohydrates	20·94	18·71
Fibre	29·17	29·21
Ash	3·41	3·00
Water	4·43	12·68
	100·00	100·00

Kernels.

European sunflower seed from which the hulls have been removed contains—

	German.	Russian.
Oil	33·48	34·25
Organic substances	54·04	54·39
(Including protein	14·12	18·80)
Ash	2·86	3·56
Water	9·62	7·80
	100·00	100·00

Oil-cake.

The cake left after expression of the oil has the following composition :—

Oil	8·94
Albuminoids	21·68
Carbohydrates	19·05
Fibre	33·00
*Ash	9·33
Water	8·00
	100·00
* Containing sand	1·37

Indian-grown seeds.

The seeds of Indian-grown sunflowers do not much differ in composition from those cultivated in Europe and America. In 1896 a parcel of the seed grown in Kashmir by Colonel A. D. Anderson, R.A., was forwarded by the Reporter on Economic Products, Calcutta, to the Imperial Institute, London. At the request of Sir F. Abel, Dr. J. A. Voelcker of the Royal Agricultural Society undertook its examination, the results of which are as follow :—

Oil	20·01
Water	8·25
*Albuminoids	17·75
Carbohydrates	18·57
Crude fibre	31·77
†Mineral matter	3·65
	100·00
* Containing nitrogen	2·85
† Including sand	·20

CHARACTERS OF THE OIL.

The amount of oil in the kernel itself, after removal of the husk, gave 44·07 as the percentage result.

The oil obtained from the seeds of the sunflower is a limpid oil of mild taste and pleasant smell.

The oil has drying properties but much weaker in action than those of linseed and poppy seed.

In samples examined in England the acidity varies from nothing to 5·6 per cent. calculated as oleic acid. The specific gravity at 15° C. ranges from 0·924 to 0·926, and the solidifying point is about —17°. The saponification value has been found to be between 188 to 194, iodine value 119·7 to 135,° and the Maumené test or the heat produced when mixed with sulphuric acid, 67·5 to 75. The fatty acids, which amount to 95 per cent., and consist chiefly of linolic with a small quantity of oleic acid, melt at 23,° possess a saponification value of 201·5, an iodine value of about 133°, and a refractive index (at 60°) of 1·4531.

Sunflower oil does not change colour with nitric acid, but cotton seed oil, if mixed with it, becomes brown with this reagent.

The oil obtained from seeds from plants grown in India has similar properties. The acid value calculated as oleic acid in four samples from Coimbatore ranged from 2·11 to 2·46 per cent.; the same value as that of a sample from Behar was 3·90. The other constants were so uniform that no analytical distinction could be observed between the oil from the Giant Russian sunflower and that from the common or garden variety.

Composition of leaves and stalks.

With regard to the composition of other parts of the sunflower plant Dr. Wiley has submitted to analysis the stalks, leaves, dried heads and husks, in addition to the seeds and kernels, the composition of which has been given above. It was noticed that the content of ash was uniformly distributed throughout the different parts of the plant. The leaves contained the greatest percentage, while the smallest was found in the shells of the seeds. The percentage of protein is high, as would be expected, in the kernels, while in the seeds and stalks it is very low.

Ash Constituents.

In order to determine the distribution of the various ash constituents of the different organs they were subjected to separate analysis. With the exception of the leaves where lime predominates potash is the principal mineral ingredient of the ash of the sunflower. The ash of the heads contains 54, the stalk 39, and the seeds 29 per cent. of this element. Lime and magnesia are important constituents in the leaves and stalks.

The principal acid in the ash is phosphoric, although the content is low in the stalks and naturally high in the seeds. If the kernels and hulls of the seeds be studied separately it is found that the percentage of phosphoric acid in the ash of the kernels is 50·84, while in the hulls it is only 6·83.

CONCLUSION

It is evident from the above data, including the composition of the sunflower itself, that it is a plant which makes considerable drain upon the three principal mineral plant foods, *viz.*, nitrogen, phosphoric acid, and potash.

Conclusion.

The following summary of the results of growing sunflowers in America is applicable in many respects to India:—

1. The sunflower is a plant which can be grown successfully over large areas.

2. From the chemical analysis of the whole plant it is evident that it is a crop making a considerable drain on the elements of soil fertilisation; therefore during cultivation it is necessary to maintain the fertility of the land.

3. One of the most valuable constituents of the plant is the oil which exists in the seeds.

4. The economic production of the sunflower plant is now confined almost exclusively to Russia, where it is an agricultural industry of considerable importance.

5. In the United States the sunflower is grown as an ornament and for the production of seeds, which are used chiefly for poultry and bird feeding, and for condimental and medicinal properties with farm animals.

6. The oil of sunflower seeds is not produced commercially in the United States. It is very palatable and, without refining, makes an excellent salad dressing. The residual oil-cake has a high nutritive value.

7. In the cultivation of the sunflower, the methods pursued for growing Indian corn are to be followed, and may be cultivated over almost as wide an area as Indian corn.

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THE AGRICULTURAL LEDGER.

1907—No. 2.

TAMARINDUS INDICA.

(TAMARIND.)

[*Dictionary of Economic Products, Vol.* VI., Pt. III, T. 28-50.]

The USES and COMPOSITION of TAMARIND SEEDS.

By DAVID HOOPER, F.C.S.

TAMARIND SEEDS WIDELY USED AS A FAMINE FOOD.

During an enquiry conducted in 1903-04 by the Reporter on Economic Products to the Government of India on foods used in times of scarcity and famine, the seeds of the tamarind tree were submitted as articles of general consumption from no less than sixty localities. It has been known for many years that the seeds are occasionally eaten by the inhabitants, but it was left for a systematic enquiry undertaken in all parts of India to reveal the extent and importance of the use of these seeds as an article of diet. In continuation of *Agricultural Ledgers* No. 7 of 1902, Nos. 4, 5 and 6 of 1904, and No. 2 of 1906, and preparatory to the publication of a complete list of Indian Famine Foods, the present Ledger deals with the description and composition, in this connection, of the above-named seeds.

The tamarind is one of the most beautiful of the common trees of India, and is frequently planted in avenues and topes. It flowers profusely in April and May; and the fruit ripens in the ensuing cold weather. A large tree yields five or six maunds ($411\frac{3}{7}$—$493\frac{5}{7}$ lbs.) of fruit. This is largely consumed, being a favourite ingredient in curries and chutnies and sauces, and is exported in bulk for medicinal purposes as East Indian tamarinds.

The fruit is a large flat pod, from four to six inches in length, filled with acid pulp, seeds and stringy fibrous matter. As sold in the bazar, the fruits contain, in one hundred parts, the following proportions of pulp, seeds and fibre:—

Pulp	55
Seeds	33·9
Shell and fibre	11·1

DESCRIPTION OF SEED.

It is thus evident that whenever the pulp is prepared for culinary purposes a large quantity of seed is removed, and in many of the town residences it is rejected as useless.

The following description of the seeds is taken from the "Pharmacographia." "The seeds are flattened and of irregular outline, being round, ovate or obtusely four-sided and about 6-10ths of an inch long by 3-10ths thick, with the edge broadly keeled or more often

slightly furrowed. The testa is of a rich brown, marked on the flat sides of the seed by a large scar or areole of rather duller polish than the surrounding portion which is somewhat radially striated. The seed is exalbuminous with thick, hard cotyledons, a short straight included radicle and a plumule in which the venation of the leaves is easily perceptible. The testa of the seed abounds in tannin, and after long boiling can be separated, leaving the cotyledons soft. The latter have a bland mucilaginous taste." One hundred seeds weigh 75·88 grams; the average weight of a seed is therefore 11·7 grains.

Uses.

USES.

Tamarind seeds are universally eaten by the poorer people of India during times of scarcity and famine, and are occasionally eaten by others at ordinary times.

The seeds have been received from the following places as a famine food.

Where considered a famine food.

Madras:—Anantapur, North Arcot, Bellary, Bhadrachalum, Chingleput, Coimbatore, Cuddalore, Cuddapah, Ganjam, Godavari, Kistna, Kurnool, Nilgiris, Vizagapatam and Yellavaram.

Central Provinces: Nagpur.

Central India: Bhopal, Bhopawar, Gwalior, Jhalawar, Malwa, Merwar, and Shahpura.

Bengal: Hughli, Monghyr, Manbhum, Murshidabad, Ranchi and Singbhum.

It would appear that as a food tamarind seeds are mostly consumed in the Madras Presidency and Central India. Kistna is the only place where it is reported that they are sold; the price given is six pies (0½*d*) for a bag of about 20 lbs.

PREPARATION FOR CONSUMPTION.

They are in great demand for the fruits by the Telegus of the Godavari district, and for this reason the tree is very valuable.

For edible purposes they are first roasted or soaked and boiled in water to remove the outer skin. After soaking in water, the brown skin is easily removed as in the blanching of almonds; and the white kernel is tolerably palatable. The kernels are dried in the sun, or roasted over a fire, and ground into flour. This flour may be at once made into cakes or chupattis, but when other cereal flour is available they are mixed in some suitable proportion before being baked into bread. In Ranchi the seeds and rice are fried and powdered and made into balls and eaten by the poorer classes. The Sonthals combine these seeds with mahwa flowers in their dietary.

Stated injurious effect

It has been reported from some districts that tamarind seeds used alone produce untoward effects. For instance, it is said that in Bhopal they produce depressing effects; in Anantapur and Cuddapah they cause constipation; in Bellary, North Arcot, diarrhœa; and in Jhalawar, inflammation. There is no doubt that if the husks are not entirely removed they are liable to cause irritation from the astringent and fibrous matter they contain, but as will be seen from the analysis of the almonds themselves they are comparatively nutritious and free from mechanically disagreeable ingredients.

possibly due to husk.

MEDICINAL USES.

The seeds in some districts are regarded as medicinal. They are powdered and given for rheumatism in the Hindu system of medicine and are administered for herpes according to the Yunani system. Some people regard the seeds as stomachic. According to Wight a paste made of the seeds simply smeared on the skin has the property of promoting suppuration in indolent ulcers. They are also said to form a convenient poultice for boils.

USE AS SIZE.

The powdered seeds boiled in a small quantity of water make a tenacious glue or size used by wool-weavers, saddlers and book-binders. This is used to dress country-made blankets. According to Nesbit, in Burma, silk thread is dyed red on being dipped into boiling water into which the seeds have been thrown. Finally the seeds boiled to a glue are said to form a strong wood cement.

Composition.

COMPOSITION.

Analysis was made of the entire seeds, and also of the kernel without the brown covering. They had the following composition:—

	Seeds.	Kernels.
Water	10·50	9·35
Albuminoids	13·87	18·06
Fat	4·50	6·60
Carbohydrates	63·22	62·88
Fibre	5·36	·66
Ash	2·55	2·45
	100·00	100·00
Nitrogen	2·22	2·89
Phosphoric anhydride	·40	·55

COMPOSITION. There is a decided difference in the composition of the shelled and unshelled seeds. The shells contain the undesirable constituents, namely, the tannin matter and fibre, and the kernels represent a nutritious food, white in appearance and with no disagreeable odour and taste.

Oil.

OIL. A statement appeared fifty years ago in the Journal of the Agri-Horticultural Society of India (Vol. IX, 1857, 1366), that a certain Captain Davis in experimenting with some jungle seeds pressed some seeds of the common Indian tamarind and obtained an oil of a fine amber colour which he thought would prove a substitute for olive oil. The odour of linseed oil was attributed to the mill having previously been used for the extraction of linseed oil. The oil was favourably reported upon by Babu Ramgopul Ghose.

Only present in very small quantities.

These statements were repeated in Exhibition Catalogues and standard works in oils, as that of Brandt, who states that the seeds contain 20 per cent. of oil of a thickly fluid nature. Another writer expresses regret that the oil has escaped the attention of natives. But no blame is attached to the natives of this country. Tamarind seeds are not oil-seeds. It was pointed out in "Pharmacographia Indica," 1890, that the dry seeds yield no oil by expression, and by solvents the yield was only 3·0 per cent. In the above analyses the seeds are shown to yield 4·5 per cent. and the kernels 6·6 per cent. of oil, a proportion not much above that found in the pulses.

Nature of oil. The oil obtained by ether is thick and light yellow in colour. It solidifies at 15° C., and gave the following constants:—

Acid value	0·84
Saponification value . .	183°
Iodine value	87·1
Fatty acids	94·9
Melting point of . . .	40°

The fatty acids crystallised twice from alcohol afforded an acid melting at 74°·5, resembling arachidic acid of ground-nut.

Elaidin reaction gives a buttery consistence. The oil is semi-drying, forming a skin only after 12 days.

G. I. C. P. O.—No. 751 R. E. P.—26-11-1907.—2,500.—J. E. J.

THE

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1907—No. 3.

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(Vegetable Product Series, No. 102.)

THE AGRICULTURAL LEDGER.

1907—No. 3.

MYRISTICA SPP.

(NUTMEGS.)

[*Dictionary of Economic Products, Vol.* V., M., 884.]

THE FATS OF INDIAN NUTMEGS.

By DAVID HOOPER, F.C.S.

INTRODUCTION.

Wild nutmeg seeds are occasionally imported into England under the name of "oil nuts," and are supplied from Africa and South America where they are said to be available in large quantities. In view of the constant and increasing demand for oil seeds in Europe it would seem desirable to examine the seeds of wild nutmeg trees of India to learn particulars of the amount and quality of the fat they contain. It has been known for many years that these seeds are oleaginous, but no special investigation has been made of them. The subject has been re-opened by the receipt from Mr. H. Latham, District Forest Officer, South Kanara, of a sample of the seeds of **Myristica canarica**, with the interesting information that they are used by the villagers in making candles. The seeds and candles were exhibited at a meeting of the Asiatic Society of Bengal held in December, 1906. They point to a source of oil for illuminating and other domestic purposes, and if obtainable in sufficient quantity would doubtless form a minor forest product of some value.

Further quantities of the seeds of **M. canarica** have been received, and they have been examined with those of **M. malabarica**, which are already an article of commerce in Bombay. The results of the chemical examination of the seeds and fat of these two indigenous nutmegs are given in the following pages, and their composition is compared with that of wild nutmegs from other countries.

Myristica canarica, *Bedd.*

Syn.—M. FARQUHARIANA, *Wall.*

Vern.—*Pindi, pundee-kai* (KAN.) ; Candle-nut tree (ENG.)

References.—*Beddome, Flora, Sylvatica, t. 270; King, Annals Calcutta Botanic Gardens, III, 307; Talbot, Systematic list, trees, shrubs, and wood climbers, Bombay, 165; Lawson, Records, Botanical Survey of India, Vol. I, 68; Christy, New Commercial Plants, No. 8, 31.*

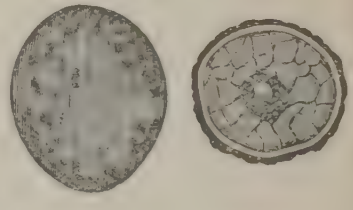
Habitat.—A large tree growing on the Western Ghats from the Konkan southwards, in Coorg, the Wynaad, Travancore and Tinnevelly. Beddome reports its occurrence in the dense moist forests in the plains of South Kanara, and that it ascends the South Kanara and Coorg ghats to 1,500 and 2,000 feet. It is also found in the Tambracherry ghat in the Wynaad, but not in North Kanara. Bourdillon describes it as an immense tree (160 feet high) of the evergreen forests of Travancore. Bourdillon and Lawson collected it at Colatoorpolay in South Travancore, growing on the drier slopes of the hills along with **M. attenuata** and **M. magnifica.** The tree flowers in February and the fruits ripen in November.

The Seeds.

Seeds.

Description.

The nutmeg is almost round like a marble, about 1—1¼ inch in diameter, downy when young but glabrous in age. As collected for use each seed is enclosed in a light-brown brittle shell, to which portions of the arillus or mace are attached. The kernel is loose inside the shell with a hoary white exterior and possessing the white and brown ruminated character of the albumen of ordinary nutmegs. The seeds weigh on an average 2·35 grams (36·26 grains) each. 100 parts of the seed yield 23·8 parts of shells and 76·2 parts of kernels.



From Mangalore.

Mr. T. Christy in "New Commercial Plants" gives a figure of this seed in an article entitled "The Nutmeg Genus." He designates the nut M. Mangalore, and says:—"I have received specimens of a nutmeg from Mangalore, of which I cannot, so far, find a description." There is very little doubt that he refers to the seed of **Myristica canarica.**

Candles.

Mr. Latham when forwarding the samples which had been collected in the Puttur Range, South Kanara, supported the identification of the *Pundi* or candle-nut tree with botanical specimens. At the same time he remarked :—"Oil is not extracted from the fruits, but they are crushed and pressed into joints of bamboo to form crude candles. No wicks are used."

The candles are quite black, and had evidently been charred during the process of manufacture. They were four to five inches

Myristica canarica.

in length by one inch in thickness. Except for the charcoal present they had the same composition as the crushed seeds, and contained half their weight of oil. They burnt with a small clear flame, giving off no smoke, and eventually were consumed, leaving a white ash.

Chemical Composition.

Composition of seeds and mace.

The entire seeds and the mace had the following composition :—

	Seeds.	Mace.
Water	7·25	5·15
Fat	49·40	54·60
Albuminoids	7·31	6·12
Carbohydrates	14·65	28·48
Fibre	20·14	3·40
Ash	1·25	2·25
	100·00	100·00

The kernels, separated from the shells, afforded 64·76 per cent. of crystalline fat.

Characters of fat.

The fat was light brown and crystalline. It gave a carmine-red colour in the cold with strong sulphuric acid. The following constants were obtained :—

Melting point	37·5°
Acid value	37·08
Saponification value	215·02
Iodine value	26·64
Fatty acids percentage	92·
Melting point	41°
Acid value	217·53

The fat saponified with great facility. The fatty acids after crystallising twice with alcohol (90 per cent.) afforded white crystals melting at 53°C., and giving an acid value of 246·1. The latter acid agrees, therefore, with myristic acid which has a melting point of 53·8° and an acid value of 245·5. To determine the proportion present of this acid, a lead salt was made of the combined fatty acids separated by saponification of the fat, and after digestion in ether, 70·8 per cent. was found to be insoluble and corresponded with lead myristate. Oleic acid was probably the only other acid present.

Myristica malabarica, *Lam.*

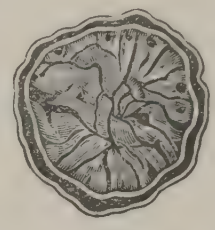
Vern.— *Kanagi* ; the nut– *pindi-kai* KAN.; The nut—*jangli jaiphal*, and *anjaiphal*, *kaiphal* ; the aril—*rampatri*, BOMB.

Habitat.—A tall evergreen tree growing in the forests of the Konkan, Kanara, Malabar and Travancore.

Seeds.

SEEDS.

The fruit is oblong, tawny and hairy. The seed is much longer than that of the common nutmeg (**M. fragrans**), and quite as broad. Each seed is more than an inch and a half long and three-quarters of an inch in diameter. The shell is nearly black, wrinkled longitudinally, and the kernel within is of the same shape and full of light red resinous and oily juice.



Bombay mace.

The arillus which is usually removed, and sold separately as "Bombay mace" or *Rampatri*, is reddish-brown. The lobes are longer and thinner than those of true mace, besides being twisted and folded into a cone at the top. The dried kernel and arillus have a slight fruity odour with scarcely any of the aroma and flavour of the true nutmeg.

Pundi Oil.

The seeds when crushed and boiled in water yield a yellowish concrete oil, known as *Pundi* oil, used in medicine and for purposes of illumination. It is made into an ointment for allaying pain, and setting up a healthy action in sores and ulcers. It is also used as an external application for rheumatism, for which purpose it is rubbed into the affected part.

Used for adulteration.

From a very early time the seeds have been used for the purpose of adulterating the nutmegs of commerce, and the arillus for adulterating commercial mace. There is a deficiency of aromatic essential oil in the Bombay products, which renders them unsuitable as a spice, and the question arises whether they could not be used for the extraction of the fat to be employed in making soap and candles.

The following results of a chemical examination show that the Bombay nutmegs yield a large quantity of fat, but it is accompanied by a reddish resin which becomes a strong colouring matter when mixed with alkalis. The purified fat is similar in composition to that of the fat of the **M. canarica**, and has special properties that could be utilised in the arts.

Chemical Composition.

The seeds of the **M. malabarica**, sold as *kaiphal* in Bombay, contained 32 per cent. of shells. The kernels were powdered and

analysed, as well as the mace or *Rampatri*, and the following results were obtained :— Analyses.

	Kernels.	Mace.
Water	6·90	4·07
Fat and resins	40·76	63·26
Albuminoids	6·50	7·31
Carbohydrates	42·18	20·80
Fibre	2·33	3·06
Ash	1·33	1·50
	100·00	100·00

The fats were both accompanied by red resins which in contact with alkalis, employed for the purpose of determining the acid and saponification values, afforded dark red liquors similar to iodine solutions. The purified fat of the kernels melted at 39°, and contained myristin, olein and free myristic acid. The fat of the mace was similar in composition, myristin constituting 40 per cent. of the total.

Bombay mace differs entirely in its composition from that of genuine mace. The following analyses of the genuine and false spice made by Arnst and Hart in 1893, show the difference; one contains a considerable quantity of essential oil and little fat, the other contains much fat and only traces of essential oil. The dried substance contains :— Genuine and false mace.

Analyses.

	Genuine mace.	Bombay mace.
Fat	26·78	61·05
Essential oil	4·12	·27
Albuminoids	9·52	5·64
Carbohydrates	53·08	22·79
Fibre	4·52	8·79
Ash	1·97	1·46

This difference is observed not only in the composition of the crude material but in the characters of the separated fats. E. Spaeth in 1895 determined the constants of the fat extracted from Bombay mace and compared them with those of genuine Banda mace with the following interesting results. The fats.

	Bombay.	Banda.
Melting point	31°	25° to 26°
Iodine number	51·3 to 53·5	78 to 80
Saponification number	189·4 to 191·4	170 to 173
Zeiss' refractometer degrees	about 48·5°	76° to 82°

It would seem that both these fats contain myristin and olein in varying proportions.

Myristica fragrans, *Houtt.* Cultivated in Penang, Malay Islands and Zanzibar. The true nutmeg.

True nutmeg.

The origin of the nutmeg and mace of commerce is alluded to in this place in order to draw attention to the fat which is sometimes sold. The expressed oil of nutmegs was formerly imported into India from Banda, and was known as *Jawitri-ka-tel* or oil of mace. It was brought into European commerce *viâ* Holland, in oblong cakes having nearly the form of common bricks, but somewhat smaller and packed in monocotyledonous leaves, commonly called "fig leaves." At the present time much of the oil is manufactured in Europe, and put up in the same shape, but packed in paper. When discoloured and hardened by age, the oil is called "Banda soap." Oil of mace is manufactured by exposing imperfect and broken nutmegs, reduced to a paste and enclosed in a bag to steam, and then pressing the bag between heated iron plates. The yield is about 20 to 30 per cent.

Oil of Mace.

Uses.

Nutmeg butter is used in Europe in the manufacture of scented oils, perfumes and soaps, and as a flavouring agent in cooking and confectionery. A great point in its favour is that it does not turn rancid, even after long storage, on account of the small quantity of essential oil combined with it.

A few references will now be made to the foreign nutmegs that have been utilised for their fat.

Myristica Bicuhyba, *Schott. and* **M. officinalis,** *Mart.;*

Ucuhuba nuts.

These trees are natives of Brazil where they are known as *Ucuhuba* or *Bicuhiba.* The seed is similar to a large acorn in shape and colour.

The seeds yield 59·6 per cent. of fat, but if separated from the shells, the kernels alone contain 73 per cent. The fat is of a deep brown colour and is tolerably firm; it possesses a peculiar aromatic odour due to ethereal oil, and gives a beautiful red colour with sulphuric acid.

Composition.

Ucuhuba fat was examined by Dr. E. Valenta in 1889. It melts at 39° C. Treatment with steam removed volatile oils and acids. After treatment with steam the fat yielded 93·4 per cent. of fatty acids, 8·8 per cent. being in a free state. The fat acids melted at 46° and possessed a saponification equivalent of 219—220, and an iodine equivalent of 9·5, alcohol separated a resinous mass having somewhat the odour of Peru balsam.

The crystals which separated from the alcohol melted at 53-53·5°; their saponification equivalent was 245-245·4, and their iodine equivalent to O. They thus consisted of myristic acid. Fractional precipitation with magnesium acetate showed that oleic acid was the only other acid present. From the iodine equivalent, the

author concludes that the fatty acids consist of 89·46 per cent. of myristic acid and 10·54 per cent. of oleic acid. This is considered favourable to the use of the fat for making candles.

Myristica surinamensis, *Roland.*

This species is abundant in the West Indies. The seeds are about the size of a small marble, and are called *Cuango* nuts by the Spaniards. **Cuango nuts.**

They have been imported into England in considerable quantity; their first appearance being at Liverpool in 1881, when they were offered as an oil seed. They have also been imported into Germany as a source of oil. An analysis was made of them by Prof. Voelcker, who obtained the following results:— **Analysis.**

Fat	60·53
Moisture	4·74
Albuminoids	5·75
Carbohydrates	20·16
Fibre	7·13
Ash	1·69
	100·00

The fat is solid at ordinary temperatures having an agreeable taste and little, if any, odour. It is readily extracted from the nuts by hot pressing or by solvents. When fairly pure, it somewhat resembles cocoa butter.

The fat was examined by Reimer and Will in 1885. The shells weigh 16 per cent. of the seed. The kernels give to hot ether 73 per cent. of fat melting at 45°. Alcohol leaves 6·6 per cent. of a yellow insoluble substance, and the fat contains 6·5 per cent. of free myristic acid.

The fat consists of almost pure myristin and a caoutchouc-like resinous substance.

Other species of nutmeg of minor importance which have been used or exported for the sake of their fat may be briefly noticed.

Myristica angolensis, *Welw.*

A native of Gaboon, where it is known as *Combo*. The seeds are said to yield nearly three-quarters of their weight of a fatty oil. They have been imported into Liverpool from St. Thomas as an oil seed. **Combo seeds.**

M. guatemalensis, *Hemsl.*

A native of Guatemala. The seeds are ovoid, about one inch long and half an inch broad, of a blackish colour, and enclosing

Suif de muscade.

a brown kernel. A specimen of the solid fat was exhibited at the Paris Exhibition of 1878, under the name of "Suif de muscade."

M. Otoba, *H. B.*

Otoba wax.

This species is a native of New Granada. The seeds are ovoid, about three-quarters of an inch long, and have a powerfully aromatic odour and taste. They yield a solid fat, which is known under the name of "Otoba wax," and is used by the natives in the treatment of skin diseases.

Myristica sebifera, *Sw.*

Myristica sebifera.

The tree is a native of Brazil, British Guiana and Cayenne. The oval seeds are about the same size as those of **M. canarica**. The seeds boiled with water yield about 26 per cent. of fat which is made into candles. This fat has been exported to some parts of Europe in the form of bricks, in considerable quantity, but is known only to a few manufacturers. It is used in soap-making, and candles made with it burn with an agreeable aromatic odour.

Myristica laurifolia, *Hook. f. and Thoms.*

Wild nutmeg of Ceylon.

This is the *Malabodde* or wild nutmeg of Ceylon. The nutmegs yield to pressure and boiling a very pure description of vegetable butter. It has been reported that the seeds are not found in sufficient abundance to make them worth the attention of merchants.

Conclusion.

Conclusion.

These few notes show that the wild nutmegs of India, like the wild nutmegs of foreign countries and the cultivated nutmegs of Malaya, yield a fat of considerable value to soap and candle makers. The question to be solved is in regard to the quantity of the material available. If the seeds of **Myristica canarica** could be obtained in large quantities when the tree fruits, there would be a ready market for them, since they compare favourably with seeds obtained from the same natural family in other parts of the world. The seeds and mace of the **M. malabarica** have also a certain economic value which it appears most desirable to extend.

G. I. C. P. O.—No. 901 R. E. P.—14-1-1908.—2,500.—B. N. D.

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(Vegetable Product Series, No. 105.)

THE

AGRICULTURAL LEDGER.

1907—No. 6.

CORCHORUS Spp.

(JUTE.)

[*Dictionary of Economic Products, Vol. II,* C., 1839—1924.]

THE RACES OF JUTE.

By I. H. BURKILL *and* R. S. FINLOW.

INTRODUCTORY.

The enquiry of which the present report is a result began in 1900 when Mr. P. C. Lyon, then Director of Land Records and Agriculture, Bengal, caused two of his staff, Babus H. C. Guha and Nibaran Chandra Chowdhuri, to tour through the jute districts collecting information about the races grown. The specimens collected were made over to Sir George Watt, Reporter on Economic Products to the Government of India, for study. Later Mr. Lyon and his successor Sir Charles Allen obtained seed of many of these races for cultivation on the Experimental Farm of His Highness the Maharajah of Bardwán. Just at the time of the inception of these experiments at Bardwán, the jute crop of 1901 caused in Calcutta an outcry that the fibre was deteriorating. Then it was that at the request of Sir Charles Allen and Mr. J. W. Mollison, Inspector-General of Agriculture, one of us in 1902 took up the interrupted work of Sir George Watt, studying first the Bardwán plots.

Alleged deterioration.

Shortly after this the Government of India referred to the Board of Scientific Advice the question of deterioration of jute and received the following reply :

"In the papers on jute submitted to the sub-committee for consideration and report it is made clear that of late years the quality of the jute fibre which comes into the market has deteriorated.

INTRODUCTORY.

The question to be considered is what may be the explanation of this fact. There are three possible explanations :—

Alleged deterioration.

1. That the plants which yield jute fibre—**Corchorus capsularis** and **C. olitorius**—have degenerated so that they do not now yield such good fibre as formerly.
2. That the plants which yield jute fibre have not degenerated, but that the fibre is either not now extracted with the same care as formerly, or is subjected to deliberate maltreatment in the way of artificial and fraudulent watering, which induces heating and discolouration.
3. That the plants which yield jute fibre have not degenerated, but that now as always there are jutes of different kinds. These kinds do not all produce fibre of equal quality suitable for the purposes of the jute trade : yet, as they are probably always the kind supposed to be most suitable to the conditions which prevail in different districts or parts of districts, it is probably often a question between growing these kinds which yield inferior fibre and not growing jute at all. Formerly it was possible for the jute trade to select from the produce of the districts most suitable to the cultivation of jute precisely those kinds most suited for the purposes of that trade. Now, it may be that the demand for jute fibre is so great that the trade is no longer able to choose what it will take, but has to be content to take what it can get.

With regard to the first possibility, the sub-committee beg to report to the Board that there is not only no proof that any degeneration in either of the jute plants has occurred, but there is strong evidence that the plants are now precisely as they were a century and more ago. The best kinds, now as then, if cultivated liberally, yield excellent crops; and their fibre, if properly extracted, is also excellent.

With regard to the second possibility, there is no indication that any radical change has come over the system of steeping and retting, but there appears to be proof that at times fraudulent watering, which induces heating and discolouration, is resorted to with the object of fictitiously increasing the weight of the fibre offered for sale. The remedy for this particular cause of deterioration obviously lies in the hands of the jute trade.

The sub-committee beg, however, to express the opinion that though this is no doubt the explanation of some of the deterioration observed and complained of, it does not explain it all, and in their belief the degeneration is largely due to the fact that whereas

INTRODUCTORY.

Alleged deterioration.

formerly only the best jute, or at all events the jute most suitable for purposes of the Dundee and Calcutta spinner, alone found a sale among jute dealers, now these dealers require so much jute that to fulfil their obligations they must purchase practically whatever jute is offered to them, knowing, as they do, that what one dealer refuses to buy another will come forward and secure.

To a certain extent perhaps the remedy for this state of affairs lies theoretically in the hands of the buyers. If they would decide only to purchase the jute most suitable for the purposes of spinners at Calcutta and Dundee, it is certain that very soon only jute suitable for these purposes would be offered for sale. But it seems clear that the matter has gone beyond the stage at which this policy is possible without at the same time incurring the risk of shutting down some of the jute mills because of a shortage in the raw material; this being the case, jute fibre must be purchased, to make up the deficiency, which has been extracted either from less suitable kinds of jute or from proper kinds grown in less suitable localities. The only thing likely to overcome the difficulty is to induce the cultivators who now grow kinds that are not the most suitable for the purposes of the spinner, to replace these by kinds that are suitable. In this Government is able to assist the trade by explaining to the cultivator what precisely the buyers' requirements are; and by further supplying the cultivators with seed of the most suitable kinds for the purpose in the various districts. In every case, however, it is necessary first to discover the most suitable kinds, in some instances it may be advisable to attempt by selection or otherwise to evolve new kinds more suitable for the purpose than any known kind."

THE NECESSITY OF DISCOVERING THE BEST KINDS.

Difficulties of our enquiry.

We have quoted the Board's opinion in full because it exactly expresses the point at which our enquiry began. We set out to ascertain the various kinds of the jute plant cultivated in India in order that out of them might be picked the most suitable kinds for the various districts. Our task has proved no easy one, for the differences between race and race are minute and demand an attention to details that a systematic botanist rarely is required to give: they are too minute for herbarium work, and must be noted among the crops. Nor do we claim to have reached a final view, but only to a stage at which some opinions may be put forward tentatively for the general advancement of the enquiry.

Progress.

As already said we began work,—one of us first, the other later,—with a collection of notes made by Babus H. C. Guha and N. C. Chowdhuri, and with every facility for study at Bardwán that could be given to us.

In 1902 we found that there were fifteen plots at the Bardwán Farm. We continued our work in 1903 upon a larger series at that

PROGRESS OF OUR ENQUIRY.

Farm. In 1904 besides the study of the Bardwán plots, augmented again by eight, tours were undertaken in the districts of Pabna, Bogra, Mymensingh, Dacca and Faridpur. In 1905 operations were interrupted, but began again in 1906 on a still larger scale. The Pusa Farm was put under contribution, so that with the Bardwán Farm we had two series of experimental plots for study : tours were made through the districts of Purneah, Dinajpur, Jalpaiguri, into the Darjeeling-Terai, to Goalpara, through Mymensingh again, in Dacca, Tipperah, Faridpur, Hughli and the 24-Pergannahs, and into Orissa. In 1907 tours were undertaken from Jalpaiguri to Rangpur, Dhubri and Serajganj, and in the districts of Nadia, Murshidabad, Rajshahi and Malda. The Pusa Farm was again of great use ; but the variety experiment had been discontinued at Bardwán.

The volume of notes collected in these tours and from the farms has become considerable.

The Bardwán plots have been of the first importance to us: they were located in the flat low part of the Bardwán Experimental Farm, and were each of one twenty-fifth of an acre. The trouble there has been to make the ground absolutely uniform. Certainly it was not so in 1902, when the experiments began. But since then uniformity has nearly been established. The method used for testing the uniformity is the simple one of scattering over the area plots of one selected race and comparing their growth. The race selected has been an acclimatised Deswal of Serajganj, which in the Bardwán records is always referred to as "Farm seed." It was used first in 1904 as plots 10, 13, 20, 30, 40 and 47 of the series and was so used again in 1906. In August 1904 all these farm-seed plots were of exactly the same growth except 30, which was three inches shorter than the others, and in September 1906 Nos. 10, 13, 20 and 30 were all of the same height, but No. 40 was three inches less and No. 47 a foot taller.

VARIATION.

We must now enumerate the directions in which jute-plants chiefly vary.

Distinction of races by colour.

Colour. Plants exhibit four colour conditions :—

1. Red stem, red petioles, red fruits, bright yellow flowers.
2. Green stem, rosy petioles, rosy fruits, red on the outside of the flower-bud and bright yellow flowers.
3. Green stem, green petioles, green fruits, no red on the outside of the flower-bud, bright yellow flowers.
4. Ditto, with pale yellow flowers.

The constancy of some of these combinations suggests interesting Mendelian experiments.

Generally the ryots select enough to isolate No. 1, but not Nos. 2 and 3 and 4. No. 1 is their "Nál" or "Lál," *i.e.*, red, each of its kind; Nos. 2 and 3 are together the "Dhaula" or white ; inter-

mediates are present, but usually not in any quantity. No. 4 we found to have been more or less completely isolated only in two races of the Bardwán Farm Experiments. VARIATION IN COLOUR.

It will be convenient in the course of what we have to relate, to denote the degree of selection by terms which have been defined to the reader; we shall speak of the selection which leaves Nos. 2, 3 and 4 mixed as selection to the usual degree, and we shall speak of selection which exceeds this as selection to an unusual degree.

Season. The effect of late sowing is to prevent the plant from growing to its proper height: late sown plants come into flower dwarfed at the same or almost the same time as they would have done sown early, unless the sowing is unreasonably late: in fact, the tendency may generally be stated to be towards flowering of a race at a constant time whatever the difference in the time of sowing may be. CONSTANCY IN TIME OF FLOWERING.

In the fixing of the time of flowering, ryots in the past have certainly done a good deal of selection, so that races have diverged considerably. It is the side-shoots which flower: arrest them, and the plant becomes late. Thus straightness and tallness go hand in hand with lateness, though not quite entirely. The race Barapát of Jagannáthganj has been selected for straightness, while yet remaining early. Early and late races. Side-shoots are pre eminently flowering shoots.

When a plant is bitten down the side-shoots develop, and one of them may take the lead and may grow into a substitute for the main stem, but however like a main stem the side-shoot may become—and it is very like if the main stem be bitten down particularly early—there becomes apparent in these side-shoots their great tendency to flower, and it leads to the early formation of fruits: these fruits attract attention by being low down on the stem. In some districts, notably Mymensingh, the abundance of early fruits, well below the level of the leaves, catches the eye at once: these early fruits are accidents said to result from depredations of cattle, and are not a feature of any race.

Seed-formation is said to be less abundant the richer the soil. This is very probable; but we have had no means of testing the statement. SEED FORMATION.

Stature is a matter of several circumstances. There are races habitually tall, and races which are not so tall, if each be under its best conditions. When each in its turn is subjected to too much water or too little water, or sown too late, the stature becomes influenced for the worse. We have no irrefutable evidence yet that the effect of flooding differs in different races, but an abundance of native statements to that effect: for the cultivators say generally that some races are more tolerant of flooding than others: and that others again are much thrown back by water on the soil. VARIATION IN STATURE.

If this be the case and for the reason—that of necessity for the sake of the comparative experiment, endeavour was made to make the

VARIATION.

Bardwán field as even as possible—then the results of the Bardwán farm do not give the relative values of the various races, but only their relative values under the Bardwán conditions. And it was wise that the Government of Bengal tried experiments with the same races at Rangpur, and sent the seed to the Experimental Farm of Babu Brajendra Kishore Roy Chowdhury at Gauripur near Mymensingh, both places on higher land, and grew them also at Faridpur on more submerged land than at Bardwán; but it is unfortunate that we are not in possession of fuller records from these places. In 1904 one of us visited Faridpur, but the plots had just been reaped; and in 1906 one of us visited Gauripur, but the variety experiment had been discontinued.

Control of retting experiments.

We are further robbed of the chance of comparing the quality and yield of fibre as we should have liked to do, because the retting water at Bardwán, being still pools on the Farm, must have changed its composition enormously as the season progressed. We propose to ret in future for comparative tests in a vat, controlling the water admitted as nicely as possible. Vats with a layer of warm jheel water in them and covered to shut out the light are ideal places for retting small quantities of jute.

Meanwhile, though so much remains to be done, we think that much good may come from the publication of our results—and most especially so if those who deal in jute will freely criticise.

NUMBER OF RACES RECOGNISED.

At the risk of being tedious we find ourselves bound to give rather fully the observations which we rely on for our conclusions, because they will be required for further work; moreover, no one has gone over the ground before us and therefore every statement has to be established.

We have recognised five cultivated races of **Corchorus olitorius**—the long podded jute, and thirty-three of **C. capsularis**—the round podded jute. Further study may cause some of these to be split up into sub-races, but at the same time is likely to show that some which we are forced at present to keep apart are not distinct enough for separation

CORCHORUS CAPSULARIS IN FARIDPUR.

Having made these preliminary remarks, we shall proceed to discuss first **C. capsularis** and then **C. olitorius**. Under each species we shall give first a discussion of the cultivated fibre plants and then any further information that we have to offer about plants grown for eating, and lastly about wild plants.

Race No. 1 Faridpur Aus.

It is useful to begin with the district of Faridpur because it is central, and we have found more race-names to be used in it than in any other district. Taking first the green-stemmed races, and starting at the town of Faridpur, we find that there are at that centre early and late green-stemmed jutes respectively called Aus and Amon, or Deshi Aus (country early), and Deshi Amon (country

late). If a crop of Aus be examined, it will be seen that the fruits and petioles are at times reddish, at times green, the stems are however green, and never red. The ryots have selected it to what we call the ordinary degree, eliminating form No. 1 of page 44, but leaving the others mixed. CORCHORUS CAPSULARIS.

The Aus of Faridpur is grown west of Faridpur towards Rájbári; and, for instance, about Pachuria and Goalundo.

It is fairly tolerant of water; but it is a mistake to think that it needs flooding. The lower corners of fields where the water gets at young plants are always the worst grown, though when already at full height, a great deal of water fails to kill it. In 1906 the floods of the end of August at their height left but a foot of its top out of water, but it took no harm, whereas **C. olitorius** alongside was killed.

At Faridpur Amon or Amonia, the late green race, is found to vary like Aus, rosy-fruited and green-fruited plants occurring together in the crops. It is much more abundant than Aus, with which it shares the names of Desi and Desal and as well the name of Ghagri (meaning unknown to us). Race No. 2 Faridpur Amon.

While Amonia occupies a large area in northern Faridpur it is represented in southern Faridpur by the race Sutpát. The old mart Deora is within the region of Sutpát, and though now so decayed that we hardly find it on the maps, it has left in the jute-trade the name "Dourah" likely to be permanent for the type of fibre generally produced in Faridpur.

We now give tables comparing the behaviour at Bardwán and Pusa of plots of Amonia and Sutpát grown side by side. The Amonia seed came originally from Pangsa, and the Sutpát seed from Deora.

Bardwán Experimental Farm.

	Amonia of Pangsa.	Sutpát of Deora.
1904.		
August 10 . .	*Just in flower* . . .	Buds just appearing.
September 22 . .	Out of flower; *some fruits quite ripe.*	Last flowers out; no fruits quite ripe.
1906.		
August 26 . .	In flower, without formed fruits.	In full flower, *beginning to form fruits.*
September 15 . .	A few flowers left; no ripe fruits.	Still in flower, no ripe fruits.

CORCHORUS CAPSULARIS.

Pusa.

Comparison of two Faridpur races.

1906.	Amonia.	Sutpát of Deora.
August 7	Not in flower	Hardly in flower.
August 26	Not yet at full flowering	Not yet at full flowering.
September 20	.....	In young fruit.
October 4	No fruits ripe yet	*A very few fruits ripe.*
October 31	Not quite ripe	*Dead ripe.*

1907 (Gonhri field).

July 23	Very first buds appearing	First buds appearing.
August 15	Coming into flower	Most of the plants still in bud, but some just forming fruits.
September 8	In flower, with young fruit	In flower, with young fruit.
September 23	Fruits of full size, but none ripe; *the leaves beginning to fall.*	Fruits of full size, but none ripe; leaves hardly falling yet.

The tables show that in point of time there is no real difference between Amonia and Sutpát, the differences that exist between the two races being chiefly in the greater branching of the latter, and perhaps the slightly greater height of Amonia.

The reader, who is not particularly interested in making a minute analysis of the races, to his own convenience may regard the two as one; but we, because we need to select from the better, prefer to separate them.

The name Sutpát means thread jute.

We have observed that Amonia and Sutpát have on the average rather smaller pods than most of the other races.

Race No. 3 at Madaripur.

This Sutpát is the Desi of Madaripur, where it is very commonly sown under this name or the names of Sutpát or Kauplá, or Desál Peti (Peti meaning little). It is grown on the sides of running waters where the silt is deposited on it and where the retting water is opaque with sediment: it is, as we have said, a somewhat branchy plant; and (i) because of the silt on its stems and (ii) its branches, it is not spoken of with praise by the cultivators, who reserve their still waters behind the river-channels for something that they prize more, *viz.*, their races Udhap and Belgáchi.

Race No. 4 Udhap of Deora.

Udhap (name meaning light or bright) is grown at Madaripur in the jheel waters and is prized. It is earlier than Kauplá or Sutpát of Deora, and does not branch. Udhap and Sutpát of Deora

were grown close together at the Bardwán Experimental Farm and at Pusa, with these results :— CORCHORUS CAPSULARIS.

Bardwán Experimental Farm.

	Udhap.	Sutpát.
1904.		
August 10	*Just a few flowers open*	Buds just appearing.
September 22	*No flowers left;* fruits not ripe	Flowers left; fruits not quite ripe.
1906.		
August 26	*Most fruits well formed*	Beginning to form fruits.
September 15	*Last flowers left,* and first fruit nearly ripe.	Fully in flower; no ripe fruit.

Pusa.

	Udhap.	Sutpát.
1906.		
August 7	*Just in flower*	Hardly in flower.
August 26	In flower	In flower.
September 20	Last flowers left	In young fruit.
October 4	*A few* fruits ripe	A very few ripe fruits.
October 21	Plants dead ripe	.....
October 31	.....	Plants dead ripe.
1907 (Gonhri field).		
July 23	First buds appearing	First buds appearing.
August 15	In flower and with young fruit.	Most of the plants still in bud, but some just forming fruit.
September 8	*Most of the fruits full size*	In flower, with young fruit.
September 23	*Just at the very beginning of fruit ripening; leaves falling a little.*	No fruits ripe yet; leaves not yet falling.

The Bardwán and Pusa experiments declare that Udhap is a little earlier than Sutpát.

Belgáchi (meaning of the mart Belgáchi)—the second superior race of Madáripur—is grown in the jheel waters with Udhap. It differs from Udhap in very little; its stem is green with a rosy flush. According to Babu N. C. Chowdhuri, who made notes at Hábiganj near Madáripur in 1899 for the Director of Land Records and Agriculture, Bengal, elgáchi had not been grown long about Race No. 5 Belgachi of Madaripur.

CORCHORUS CAPSULARIS.

that village. Grown by the side of Udhap, Belgáchi behaved thus:—

Bardwán Experimental Farm.

1904.	Belgáchi of Madáripur.	Udhap of Deora.
August 10	In young bud	*Just a few flowers open.*
September 22	No flowers left; *a few fruits dead ripe.*	No flowers left; fruits not ripe.
1906.		
August 26	Beginning to form fruits	*Many fruits well formed.*
September 15	Last flowers open; plenty of nearly ripe fruit.	Last flowers open; first fruits nearly ripe.

Pusa.

1906.	Belgáchi of Madáripur.	Udhap of Deora.
August 7	Not in flower	*Just in flower.*
August 26	In flower and beginning to form fruit.	In flower with a few fruits.
September 20	In flower, and with fruits not quite full size.	Few flowers; some *fruits just full size.*
October 4	Fruits beginning to ripen	Fruits beginning to ripen.
October 21	.....	*Dead ripe.*
October 29	Dead ripe	.....
1907 (Gonhri field).		
July 23	No buds yet on the green stemmed plants, but a few on plants with a reddish tinge.	*First buds appearing.*
August 15	A very few young fruits	In flower, and with young fruit.
September 8	In flower, and with young fruit	Much of the fruit of full size.
September 23	No fruit ripe yet; leaves not yet falling.	*Just at the very beginning of fruit ripening; leaves falling a little.*

Comparison of two Faridpur races.

Thus it is a very little later than Udhap. On August the 10th, 1904, at Bardwán it was half a foot taller than Sutpát; at Pusa on August the 6th, 1906, it was fifteen inches taller; at Bardwán on September the 15th, 1906, it was of the same height.

Bardwán Experimental Farm.

1904.	Belgáchi.	Amonia.
August 10	In young bud	*Just in flower.*
September 22	No flowers left; a few fruits dead ripe.	No flowers left; a few fruits dead ripe.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm—contd.

1906.	Belgachi.	Amonia.
August 26 . .	*Beginning to form fruit.* .	In flower, without any formed fruits.
September 15 . .	Last flowers open; plenty of nearly ripe fruit.	Last flowers open; no fruit quite ripe.

Pusa.

1906.	Belgáchi.	Amonia.
August 7 . .	Not in flower	Not in flower.
August 26 . .	In flower and *beginning to form fruit.*	Not yet at full flowering.
September 20 . .	In flower and with fruits not quite full size.	.....
October 4 . .	*Fruit beginning to ripen* .	No fruits ripe yet.
October 29 . .	*Dead ripe*	.....
October 31 . .	.....	Not quite dead ripe.

1907 (Gonhri field).

July 23 . .	No buds as yet . . .	*Very first buds appearing.*
August 15 . .	*A very few young fruits.* .	Coming into flower.
September 8 . .	In flower, and with young fruit.	In flower, and with young fruit.
September 23 . .	No fruit ripe yet; leaves not yet falling.	Fruits of full size, but none ripe; *leaves beginning to fall.*

Comparing Belgáchi with Amonia, we find them practically synchronous. They are both later than Udhap, and the chief way in which they differ is that Belgáchi has been carefully selected so as to eliminate the rosy petioles and fruits, which are commoner than green, in Amonia. A second way is in the size of the fruits.

Kamarjani of Goalundo does not differ from No. 5.

The race Kamárjáni (meaning jute from Kamárjáni on the Bráhmáputra in the Mymensingh district) which is grown at Goalundo may be compared with Belgáchi. In time of growth when sown alongside that race it behaved thus :—

Bardwán Experimental Farm.

1902.	Kamárjáni.	Belgáchi of Faridpur.
August 28 . .	Just in flower. . . .	Just in flower.
1903.		
August 2 . .	No sign of flowers . .	No sign of flowers.
September 10 . .	Had been in flower about 14 days.	Had been in flower about 14 days.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm—contd.

	Kamárjáni.	Belgáchi of Faridpur.
1904.		
August 10	Just in bud	In young bud.
September 22	Out of flower; some fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	Beginning to form fruits	Beginning to form fruits.
September 15	Last flowers; no fruits quite ripe.	Last flowers; plenty of nearly ripe fruits.

Pusa.

	Kamárjáni.	Belgáchi of Faridpur.
1906.		
August 7	Not in flower	Not in flower.
August 26	Very few flowers indeed	In flower and *beginning to form fruits.*
September 20	In flower, with young fruit	In flower, with fruits not quite full size.
October 4	*Just a few fruits ripe*	Fruits beginning to ripen.
October 29	Dead ripe	Dead ripe.
1907 (Gonhri field).		
July 23	Buds just appearing	No buds yet on the green-stemmed plants, but a few on plants with a reddish tinge.
August 15	A few flowers	*A very few young fruits.*
September 8	In flower, and with young fruit	In flower, and with young fruit.
September 19	A few flowers left; much young fruit.	Much young fruit.
September 23	No fruits ripe yet; *leaves beginning to fall.*	No fruit ripe yet; leaves not yet falling.

In colour, size, as well as in season they are so similar that we regard the two as one race. The jutes of Kamárjáni are discussed on pages 76 and 88 forward; there the commonest race is Dháulá Aus equivalent to Serajganj Desoál, which, however, is not the same as this Kamárjáni of Faridpur.

The country names of red-stemmed jutes of the Faridpur district are Meghnál (from megh=a cloud, referring to the dark colour, and nál=lál, *i.e.*, red), Lálpát or Nálpát (red jute), and Sujimani (apparently meaning sun-bright jewel): together with these we have found the name of Bidya Sundár to be known at Faridpur, and the race so called was from imported seed.

CORCHORUS CAPSULARIS.

Race No. 6 Meghnal or Nalpat of Faridpur.

Comparison of two Faridpur races.

The names Meghnál and Nálpát undoubtedly belong to the same race. We have studied it in cultivation at Bardwán and Pusa, and so are enabled to institute exact and useful comparisons with other Faridpur races. It is a late race, but earlier than Amonia.

Bardwán Experimental Farm.

	Nálpát or Meghnál of Rájbári.	Amonia of Faridpur.
1902.		
August 28	In flower and *beginning to form fruits.*	Just in flower.
1903.		
August 2	Not yet in bud	Not yet in bud.
September 10	*Has been in flower about 25 days.*	Has been in flower about 20 days.
1904.		
August 10	Just in bud	*Just in flower.*
September 22	With nearly ripe fruit	No flowers left; *some fruit ripe.*
1906.		
August 26	In flower, and *with a little young fruit.*	In flower, without having yet formed fruits.
September 15	*No flowers left;* no fruits ripe yet.	A few flowers left; no ripe fruits.

Pusa.

	Nálpát or Meghnál of Rájbári.	Amonia of Faridpur.
1906.		
August 7	Not *quite* in flower	Not in flower.
August 26	*A few side plants have formed fruit.*	Just in flower.
October 4	*A very few fruits ripe*	No fruit ripe yet.
October 21	*De ri pe*	.....
October 31	.....	Not quite ripe.
1907 (Gonhri field).		
July 23	Very first buds appearing	Very first buds appearing.
August 15	Coming to *full* flower	Coming into flower.
September 8	*Much* young fruit	In flower, with young fruit.
September 19	*Fruit full size*	Few flowers left; much young fruit.
September 23	*Just at the very beginning of fruit ripening;* leaves beginning to fall.	Fruits of full size but none ripe; leaves beginning to fall.

CORCHORUS CAPSULARIS.

Pusa—contd.

Comparison of two Faridpur races.

	Nálpát or Meghnál of Rájbári.	Amonia of Faridpur
1907 (South Pangabri field).		
	Plots Nos. 15 and 5.	
July 25	Just forming buds	*First flowers open.*
August 23	About full flowering	Many young fruits.
September 8	*First fruits of full size*	Still flowering; with plenty of young fruits.
September 23	*Fruits almost ripe; a little riper than on Amonia.*	No fruits ripe; but many full size; leaves just beginning to fall.

Sujimani is a name of a red-stemmed jute of Madaripur which is grown in the still jheel waters alongside of Belgáchi and Udhap. It seems to us that it is probably the Meghnál of Faridpur; but this is a point that we have not established.

In addition to the races named already, we have specimens called Dhapa, Dhupri and Kohap and Shani. Probably the first three names are connected with the word Dhup, meaning light. They are green-stemmed plants like Amon and Udhap.

Race No. 7 introduced.

We found a crop at Faridpur in 1904 called Parbatya (*i.e.*, highland jute), the seed for which was, the ryots said, introduced from Dacca way. There is no reason to doubt this, the plant being exactly the Dacca Parbatya. With Parbatya of the Dacca district we shall deal almost directly.

BAKARGANJ.

Race No 3 again.

Race No. 6.

One jute known to us from Bákarganj is Pechi pát or Sut pát or Cowpla pát, which is evidently the race of Madáripur, and another has reached us as Rakta bági or Shonamukti. It we believe to be Nálpát. The name Shonamukti is a very curious one: it means gold-tipped, while Rakta bági means deep red bági or jute: but the word bogi or bági is generally applied to **C. olitorius.**

DACCA.

Race No. 7 Dhalsunder or Dhaleswari.

Proceeding to the District of Dacca which faces Faridpur across the Padma, the great crop of the neighbourhood of Náráinganj is called there Dhálsundar or Dháleswári or Dhála pát. It is grown by the side of races called respectively Kájla or Kájli and Bidya Sundar. We have had under study at Bardwán and Pusa a plot labelled Dháleswári and a plot labelled Dhálsundar, both originating from the village of Narsingdi—and we have found them to be identical. Further, from Narsingdi has been sent seed called Parbatya. In the next table we compare the behaviour of all three and find them identical.

CORCHORUS CAPSULARIS.

Comparison of three strains from Dacca.

Bardwán Experimental Farm.

	Dháleswári.	Dhálsundar.	Parbatya.
1903.			
August 2	No sign of flowers yet.	No sign of flowers yet.	No sign of flowers yet.
September 10	In flower; and with young fruit.	In flower; and with young fruit.	In flower, and with the *fruit not quite full size.*
1904.			
August 10	*Just coming into flower.*	In very young bud	Just in bud.
September 22	Out of flower; a few fruits quite ripe.	Out of flower; a few fruits ripe.	Out of flower; fruits not quite ripe.
1906.			
August 26	In flower; with a few young fruits.	In flower; with a few young fruits.	In flower; with a few young fruits.
September 15	A few flowers left; no ripe fruits yet.	A few flowers left; no ripe fruits yet.	The last flowers left; no ripe fruits yet.

Pusa.

	Dháleswári.	Dhálsundar.	Parbatya.
1906.			
August 7	Not yet in flower	Not yet in flower	Not yet in flower.
August 26	In full flower	In full flower with scarcely any fruit formed yet.	In flower with a *few young fruits.*
September 20	With young fruit	A few flowers left; with young fruit.	With young fruit
October 4	A few fruits ripe	A few fruits ripe	A few fruits ripe.
October 10	About half the fruits ripe.	A fair number of fruits ripe.	About half the fruits ripe.
October 21	Plants dead ripe	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).			
July 23	No sign of flowers yet	*Buds appearing*	*Buds appearing.*
August 15	Just the first flowers	Coming into flower	Just in flower.
September 8	In full flower, and with a fair number of young fruits,	*Fruits attaining full size.*	*Fruits attaining full size.*
September 19	Fruits full size	Much fruits of full size.	Fruits full size.
September 23	Not quite at the beginning of fruit ripening; leaves beginning to fall.	*Just at the beginning of fruit ripening;* leaves hardly falling yet.	*Just at the beginning of fruit ripening;* leaves beginning to fall.

CORCHORUS CAPSULARIS.

In 1904 one of us was at Faridpur on August 29th, at Pachuria on August 30th, and at Náráinganj on September 1st—nearly consecutive dates: and on them Amon of Faridpur, Dháleswári of Pachuria, and Dháleswári of Náráinganj were all found to be at the same stage. Again on September 16th, one of us was at Náráinganj and on the 18th at Madáripur. At the last date Udhap and Belgáchi bore full-sized but not ripe fruit, and Dháleswari at Náráinganj was approaching the same condition. When we compare Dháleswári and Udhap we find that the latter is, by a little, earlier than the former, just as it is a little earlier than Amonia of Faridpur. In the next table we give our comparison of Dháleswári and Udhap in order to show this.

Dhaleswari and Udhap compared.

Barduan Experimental Farm.

1904.	Dháleswári.	Udhap.
August 10 . .	Just beginning to flower; six inches shorter than Baran.	Just a few flowers open; as high as Baran.
September 22 . .	Out of flower, *just a few fit for dead ripe.*	Out of flower; fruits not quite ripe.
1906.		
August 26 . .	In flower, with a few young fruits.	*Many fruits* well formed.
September 15 . .	The very last flowers out; no ripe fruits yet; a very little shorter than Baran.	Last flowers open; *first fruits nearly ripe*; a very little shorter than Baran.

Pusa.

1906.	Dháleswári.	Udhap.
August 7 . . .	Not yet in flower; a very little shorter than Baran.	*Just in flower.*
August 26 . .	In full flower	In flower and *with a few fruits.*
September 20 . .	With young fruits . . .	A few flowers left; *some fruits just full size.*
October 4 . .	A few fruits ripe, nine feet high.	Fruits beginning to ripen.
October 10 . .	About half the fruits ripe. .	Most of the fruits are still unripe.
October 21 . .	Plants dead ripe . . .	Plants dead ripe.
1907 (Gonhri field).		
July 23 . . .	No sign of flowers yet . .	*First buds appearing.*
August 15 . .	Just the first flowers . .	In flower and with young fruit.
September 8 . .	In full flower, and with a fair number of young fruits.	*Most of the fruit full sized.*
September 23 . .	Not quite at the beginning of fruit ripening; leaves beginning to fall.	*Just at the very beginning of fruit ripening;* leaves falling a little.

CORCHORUS CAPSULARIS.

Race No. 8 Kajla.

Kájla or Kájli (the name means dark) is recognised by the cultivators of Náráingan) as rosy-stemmed. They grow it with the very similar (colour excepted) Dháleswári, sometimes mixed, but as often separate. It seems as if Kájla and the Dháleswári of Náráinganj represent current attempts at local improvement. Kájla has not been narrowly selected, but is rather variable. Ryots of Náráinganj have assured us that it is a little earlier than their Dháleswári, and we thought that borne out by examination of crops there, but in the experimental cultivation at Bardwán and Pusa it was on the whole synchronous in growth.

The relations of Desi of Narsingdi.

Desi at Narsingdi is grown on the river banks where the water is thigh-deep, while Dhálsundar is grown away back from the river where the level of the water is more constant. The stems have a rosy tint very generally, but selection hardly exceeds the ordinary degree, so that green-fruited, green-stemmed plants are present among the red-fruited and rosy-stemmed, but they are in a considerable minority. Cultivators at Narsingdi assured us that their Desi and Dhálsundar fruited at exactly the same time.

Desi of Narsingdi grown under name of Desi Nallya at Bardwan.

The Desi of Narsingdi, just as we saw it, has been grown in the Farm Experiments under the name of Desi Nallya, the so-called "Desi of Narsingdi" of the Farm being somewhat different, pure green and later.

Desi of Dacc as cultivated differs from the Desi of Narsingdi as seen at Narsingdi which was cultivated as Desi Nallya.

It is now necessary for us to show how the plants named "Desi Nallya" were earlier than those named "Desi of Dacca," and this we do in the following table :—

Bardwán Experimental Farm.

	"Desi of Dacca" of *Farm Experiments.*	"Desi Nallya" of *Farm Experiments.*
1903.		
August 2	Hardly in bud yet	Hardly in bud.
September 10	With very young fruits	*Fruits full size, 7-9 feet high.*
1904.		
August 10	Hardly in bud	No sign of flowers.
September 22	No fruits quite ripe	No fruits ripe yet.
1906.		
August 26	Just in flower	*Beginning to form fruits.*
September 15	A fair number of flowers; still no fruits ripe	*Last few flowers left; no fruits ripe yet.*

CORCHORUS CAPSULARIS.

Pusa.

	"Desi of Dacca."	"Desi Nallya."
1906.		
August 7	Not yet in flower	Not yet in flower.
August 26	Not at full flowering	In flower; with *a few young fruits.*
September 20	With a fair number of flowers, and with young fruit.	*A few flowers left;* no fruits ripe.
October 4	A very few fruits ripe	*Majority of the fruits ripe;* plants 8½ feet high.
October 10	A fair number of fruits ripe	*Plants dead ripe.*
November 2	Almost dead ripe	.....
1907 (Gonhri field).		
July 23	Just commencing to show buds	Just commencing to show buds.
August 24	In full flower; no fruits yet	*In full flower; some of the fruit of full size.*
September 8	Most of the fruits of full size	Most of the fruits of full size.
September 23	No fruit ripe yet; leaves not yet falling.	*Not quite at fruit ripening; leaves beginning to fall.*

Why Desi of Narsingdi may be doubtfully classed as Kajla, race No. 8.

The Narsingdi Desi Nallya by its rosy tint recalls Kájla. We shall therefore put our experimental results for these two side by side.

Bardwán Experimental Farm.

	Desi or so-called "Desi of Narsingdi."	Kájla of Narsingdi.
1903.		
August 2	Hardly in bud	The more red plants just in bud. The others hardly.
September 10	Fruits full size; 7-9 feet high	Fruits full size; 6-7 feet high.
1904.		
August 10	No sign of flowers; ten inches shorter than Baran.	Just in bud; six inches shorter than Baran.
September 22	No fruits ripe yet	No fruits ripe yet.
1906.		
August 26	Beginning to form fruits	Beginning to form fruits.
September 15	Last few flowers left; no fruits ripe yet; six inches shorter than Baran.	Last flowers left; no fruits ripe yet; twelve inches shorter than Baran.

Pusa.

1906.	Desi Nallya of Narsingdi.	Kájla of Narsingdi.
August 7	Not yet in flower	Just in flower.
August 26	In flower with a few young fruits.	In flower with a very few young fruits.
September 20	*A few flowers* left; no fruits ripe.	Still with plenty of flowers; no fruits ripe.
October 4	*Majority of the fruits ripe;* plants 8½ feet high.	Most of the fruits still unripe; plants 8½ feet high.
October 10	*Plants dead ripe*	.....
October 19	.....	Dead ripe.

1907 (Gonhri field).

July 23	Just commencing to show buds	Commencing to show buds.
August 15	In full flower	In flower.
September 8	Most of the fruits of full size	Many fruits full size.
September 19	Fruits full size	Most of the fruits full size.
September 23	Not quite at fruit ripening; leaves beginning to fall.	*Just at the beginning of fruit ripening;* leaves beginning to fall.

They show that Kájla had a tendency to begin flowering before Desi, but its flowering seemed to last longer. However, the differences are very small, and we feel bound to regard the two rather as one race

Race No. 10 Bidya Sundar.

The third Náráinganj race is Bidya Sundar, and is deep red in the stem and fruits. It flowers with the two preceding Náráinganj races; but did not become dead ripe until a little later. The name means "excellent knowledge."

Bardwán Experimental Farm.

1903.	Dháleswári.	Kájla.	Bidya Sundar.
August 2	Not in flower	Just in bud	Not in flower.
September 10	.....	Fruits full size	Just in flower.
1904.			
August 10	Just coming into flower	Just in bud	Just in flower.
September 22	Out of flower; a few fruits dead ripe.	No fruits ripe yet	Fruits not quit ripe.
1906.			
August 26	In flowet with a few young fruits.	Beginning to form fruits.	In flower.
September 15	A few flowers left; no ripe fruits yet.	The last flowers left; no ripe fruits.	A fair number of flowers left; no fruits ripe.

CORCHORUS CAPSULARIS.

Comparison of three Dacca races.

Pusa.

1906.	Dháleswári.	Kájla.	Bidya Sundar.
August 7	Not yet in flower	Just in flower	Not yet in flower.
August 26	In full flower	In flower with a few very young fruits.	In flower with a few young fruits.
September 20	With young fruits	In flower with young fruit.	With young fruit.
October 4	A few fruits ripe	A few fruits ripe	A few fruits ripe.
October 10	About half the fruits ripe.	About half of the fruits ripe.	A fair number of fruits ripe.
October 17	Very nearly dead ripe	Very nearly ripe	.....
October 21	*Dead ripe*	*Dead ripe*	.....
October 29	.....	.....	Dead ripe.

1907 (Gonhri field).

July 23	No sign of flowers yet.	Commencing to show buds.	No sign of flowers yet.
August 15	Just the first flowers	In flower	Coming into full flower.
September 8	In full flower, and with a fair number of young fruits.	*Many fruits of full size.*	Bearing young fruit.
September 23	Not quite at the beginning of fruit ripening; leaves beginning to fall.	No fruit ripe yet; leaves beginning to fall.	No fruit ripe yet; leaves beginning to fall.

Comparison of Bidya Sundar with Nalpat or Meghnal.

Comparing it with the Faridpur Nálpát or Meghnál we find that it is a very little later.

Bardwán Experimental Farm.

	Bidya Sundar.	Nálpát of Faridpur.
1903.		
August 2	No sign of buds yet	No sign of buds yet.
1904.		
August 10	*Just in flower*	Just in bud.
September 22	Fruits not quite ripe	Fruits not quite ripe.
1906.		
August 26	In flower	In flower, and with a few young fruits.
September 15	A fair number of flowers left; no fruits ripe.	*No flowers left*; no fruits ripe yet.

CORCHORUS CAPSULARIS.

Comparison of Bidya Sundar with Nalpat.

Pusa.

1906.	Bidya Sundar.	Nálpát of Faridpur.
August 7	Not yet in flower	Not quite in flower.
August 26	In flower with a few young fruits	A few side plants have formed fruit.
September 20	With flowers and with young fruit.	With a fair number of flowers; fruits not yet full size.
October 4	A few fruits ripe	A very few fruits ripe.
October 21	.....	*Plants dead ripe.*
October 31	Plants dead ripe	.....
1907.		
July 23	No sign of flowers yet	*Very first buds appearing.*
August 15	Coming into full flower	Coming into full flower.
August 24	In flower with young fruits	In flower with young fruits.
September 8	Bearing young fruits	*Much young fruit.*
September 23	No fruit ripe yet; leaves beginning to fall.	*Just at the very beginning of fruit ripening;* leaves beginning to fall.

Race No. 5—Belgachi—again.

Belgáchi of Dacca is essentially the same as the Belgáchi of Faridpur,—an improved race, selection of which has been carried beyond the ordinary degree, so that rosy-fruited plants are rare in it. It is something to be compared with Dháleswári, which we have already shown to be practically identical with Dhálsundar and Parbatya. With these it is practically synchronous. Than Desi it is evidently more selected, but otherwise not dissimilar as the following table shows.

Bardwán Experimental Farm.

1903.	Belgáchi of Dacca.	Belgáchi of Faridpur.	Desi of Dacca.
August 2	Hardly in bud	No sign of flowers	Hardly in bud yet.
September 10	Fruits *nearly full size*	.....	In very young fruit.
1904.			
August 10	Just in bud	In young bud	Hardly in bud.
September 22	A few flowers left; fruits not ripe yet.	.....	No fruits quite ripe.
1906.			
August 26	In flower	In flower *with a few young fruits.*	Just in flower.
September 15	Last flowers open; no ripe fruits.	Last flowers open; no ripe fruits.	A fair number of flowers left; no fruits ripe.

CORCHORUS CAPSULARIS.

Belgachi compared.

Pusa.

1906.	Belgáchi of Dacca.	Belgáchi of Faridpur.	Desi of Narsingdi.
August 7	Not yet in flower	Not in flower	Not yet in flower.
August 26	Coming into flower	In flower and *beginning to form fruit.*	Not at full flowering.
September 20	In flower	In flower and with young fruits.	With a fair number of flowers and in young fruit.
October 4	A very few fruits ripe.	Fruits beginning to ripen.	A very few fruits ripe.
October 10	Not many fruits ripe	.....	A fair number of fruits ripe.
October 29	*Dead ripe*	*Dead ripe*	.....
November 2	.....	.....	Almost dead ripe.

1907 (Gonhri field).

July 23	Just the first buds appearing.	No buds as yet on the green-stemmed plants, but a few on the plants with a reddish tint.	Just commencing to show buds.
August 15	Coming into full flower with a few young fruits.	In flower with a very few young fruits.	In full flower.
September 8	In flower with much young fruit.	In flower, and with young fruit.	*Most of the fruit of full size.*
September 23	No fruits ripe yet; leaves not falling.	No fruits ripe yet; leaves not falling.	No fruits ripe yet; leaves not falling.

1907 (South Pangabri field).

Plots Nos. 4 and 16.

	Belgáchi of Dacca, plot No. 4.		Desi, plot No. 16.
July 25	Buds appearing	.....	With buds.
August 23	A very few fruits formed.	.....	Hardly at full flowering yet.
September 8	Flowering, with many young fruits.	.....	Flowering, with many young fruits.
September 23	No fruits ripe yet; leaves not yet falling.	.....	No fruits ripe; leaves just beginning to fall.

Agniswar is Bidya Sundar.

Agniswár is apparently a rare crop of Narsingdi, Dacca, which does not differ from Bidya Sundar: Bidya Sundar is the Náráinganj name and Agniswár the Narsingdi. They differ from Dhálsundar chiefly in their red stems (ag = fire, *i.e.*, having the colour of fire).

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TIPPERA.

Proceeding from Dacca to Tippera we find not unnaturally that several Dacca names and races go with us: Dháleswári or Dhálsundar is among the races, and both names are known for it at Chándpur and Hájiganj, though the first is best known. The race does not seem to have changed between Náráinganj and Chándpur.

Race No. 7 again.

Kájla is another name which reaches Chándpur. Discussing, just above, the Kájla of Náráinganj, we concluded that there it is not a fully selected race, varying greatly. We find reason to consider the Kájla of Chándpur exactly the same as the Kájla of Náráinganj.

Race No. 8 again.

Bidya Sundar, the third race of Náráinganj, is the Bidya Sundar of Chándpur. It is considered to give the finest fibre, and this is perhaps due to the practice of cutting it a little earlier than the others. It is plentifully seen all along the river banks from just below Náráinganj to Chándpur, but behind Chándpur at Hájiganj it was not seen by us as a pure crop, but only as a stray plant, here and there, among Dháleswári.

Race No. 10 again.

The names of Tippera strains which are not known to us as common with the Dacca district, are Deodháli and Phuleswári. Deodháli is said to mean "white like a god." It is said by Guha to yield fibre second to Bidya Sundar in quantity. We found it at Chándpur with a green stem and rosy fruits. Phuleswári we have not seen in the fields. Both Deodháli and Phuleswári have been grown in the experiments that we have watched. They, compared with Dháleshwári of Dacca, behaved as follows:—

Race No. 11 Deodhali.
Race No. 12 Phuleswari.

Bardwán Experimental Farm.

	Deodháli.	Phuleswári.	Dháleswári.
1903.			
August 2	No buds	No buds	No buds.
September 10	Just in flower	Just in flower	*In young fruit.*
1904.			
August 10	In bud	Hardly in bud	In very young bud.
September 22	No fruits quite ripe	No fruits quite ripe	Out of flower; a few fruits ripe.
1906.			
August 26	In flower	Beginning to form fruits.	Beginning to form fruits.
September 15	Last flowers left; no ripe fruits.	Last flowers left; no ripe fruits.	The last flowers left; no fruits quite ripe.

CORCHORUS CAPSULARIS.

Two Tippera races compared with Dhaleswari.

Pusa.

1906.	Deodháli.	Phuleswári.	Dháleswári.
ust 7 .	*Hardly in flower* .	Only in bud . .	Not yet in flower.
August 26 .	A very few young fruits.	A very few young fruits.	Scarcely any fruit formed yet.
September 20 .	Still flowering; fruits not quite full size.	Still flowering; fruits not full size.	A few flowers with young fruits.
October 4 .	A few fruits just ripe .	A very few fruits ripe	A few fruits ripe.
October 21 .	.....	.....	Dead ripe.
October 31 .	.....	Dead ripe . .	.....
November 2 .	Dead ripe . . .	.....	.....
1907 (Gonhri field).			
July 23 . .	Just showing buds .	Just showing buds .	No sign of flowers yet.
August 16 .	*Coming into full flower, and with a few young fruits.*	*Coming into full flower, and with a few young fruits.*	Just the first flowers.
August 25 .	In flower, with only a few fruits.	In flower, with a few fruits of full size.	In flower, with a few fruits of full size.
September 8 .	With much young fruit.	Much young fruit and *a few at full size.*	In full flower and with a fair number of young fruits.
September 19 .	A few flowers still; much young fruit.	*Most of the fruits of full size.*	*Fruit of full size.*
September 23 .	No fruit ripe yet; leaves not beginning to fall.	*A very little fruit ripe;* leaves not beginning to fall.	Not quite at the beginning of fruit ripening; *leaves beginning to fall.*

The conclusion from the comparison is that Deodháli and Phuleswári are synchronous and later races than Dháleswári. Deodháli does not differ from Phuleswári in anything except the colour of the flower. In 1904, they were not side by side at Bardwán; and they behaved somewhat differently, Deodháli outgrowing Phuleswári. In 1906 at Pusa, Deodháli again at first outgrew Phuleswári, but by very little; and they ended of equal height.

Dháli of Chándpur is apparently the same as Deodháli.

Race No. 3. Pechi, which we have not seen, may possibly be the Desál peti of Madáripur.

NOAKHALI. There is a very little cultivation of **C. capsularis** in the district of Noakháli, chiefly in the Thannas of Rámganj and Lakhipur. It is generally called Nalita. We do not know what races are grown.

PABNA. The district of Pabna is conveniently taken next. About Serájganj four races are grown: Barápát, Desoál or Deswál, Kákyá Bombái, and Náiltá or Láli: the race Náiltá is rare at Serájganj: it

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The races of Serajganj compared.

has not been in cultivation at Bardwán; but the three others have been cultivated and under observation since 1902.

We will establish their relationships to each other first by a table:—

Bardwán Experimental Farm.

	Barápát.	Desoál.	Kákyá Bombái.
1903.			
August 2	*Flowers just open*	Very small buds	No sign of flowers.
September 10	.....	Pods nearly full size.	With half sized fruits.
1904.			
August 10	*Just in flower*	*In flower*	Not even in bud.
September 22	No flowers left; *many fruits dead ripe.*	Out of flower; a few fruits dead ripe.	Still flowering; no fruits ripe yet.
1905.			
August 26	With young fruits	With some young fruits.	With some young fruits.
September 15	*Out of flower;* no fruits ripe yet.	Very last flowers open; no fruits ripe yet.	Very last flowers open; no fruits ripe yet.
1907.			
August 15	*In flower, more so than Desoál and Kákyá Bombái, with a few small fruits.*	In flower, no fruits	Just in flower, no fruits.
September 20	Almost out of flower; fruit of full size but not ripe; *leaves beginning to fall.*	In flower, with plenty of full sized but unripe fruits; leaves not yet falling.	Near the end of flowering, much fruits of full size, leaves not yet falling.

Pusa.

	Barápát.	Desoál.	Kákyá Bombái.
1906.			
August 7	*Just in flower*	Not in flower	Not in flower.
August 26	*Half the plants with young fruits.*	In full flower	Not yet in full flower.
September 20	Just a few flowers left, *fruits full size.*	Flowering still; some fruits full size.	Still in flower, no fruits full size.
October 4	Out of flower; *half the fruits ripe.*	Out of flower; a few fruits ripe.	Out of flower, fruits full size, a few ripe.
October 10	*Practically dead ripe.*	.....	.....
October 21	.....	Most of fruits almost dead ripe.	.....
November 2	.....	.....	Dead ripe.

CORCHORUS CAPSULARIS.

Pusa—contd.

The races of Serajganj compared.

	Barápát.	Desoál.	Kákyá Bombái.
1907 (Gonhri field).			
July 23	Just the first buds	Buds just appearing	Just the first buds.
August 15	*In full flower*, with just a few young fruits.	Not yet at full flowering; some young fruits.	In flower, with a few young fruits.
September 8	Many fruits of full size.	Many fruits of full size.	In full flower and with plenty of young fruits.
September 19	Fruits full size	Last flowers; much full-sized fruit.	Some flowers left, young fruit.
September 23	*A general sprinkling of ripe fruits*; leaves beginning to fall.	Just a few fruits ripe and just beginning to lose its leaves.	No fruit ripe yet; leaves not yet beginning to fall.
1907 (South Pangabri field).			
Plots Nos. 17, 25 and 8.			
July 25	*Just in flower*	Just coming into bud.	Buds appearing.
August 23	*Getting out of flower*.	Coming into full flower.	Well in flower.
September 8	*Most* fruit full size	Some fruit full size	In flower with young fruits.
September 23	*About one-quarter of the fruits dead ripe; plants losing their leaves.*	No fruits quite ripe; leaves not falling yet.	No fruits ripe yet; leaves not yet falling.

Selection of Desoal into "Bardwan Farm-seed."

Desoál is not a highly selected race; and much variability is found in it, both in the colour of the fruits, and in the time of coming into flower, and fruiting. For this reason a little simple selection enables one to separate more than one race out of it. We consider as an incipient race the "Farm seed" of Bardwán. Its history is as follows:—In 1895 seed of Desoál was procured, and sown on the Bardwán Farm: at first it was not subjected to any particular selection, but after 1899 an idea was conceived that Desoál should be a certain type and thereafter for some years in thinning the plots young plants which did not conform to the type were pulled out. The present "Farm seed" of Bardwán differs a very little from Desoál. It has fewer rosy fruited plants, and under Bardwán conditions gives a better yield. In point of time there has been developed no difference.

Bardwán Experimental Farm.

1903.	Bardwán Farm seed.	Desoál.
August 2	No sign of flowers	Very small buds.
September 10	*Pods full sized*	Pods nearly full size.

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Bardwán Experimental Farm—contd.

	Bardwán Farm seed.	Desoál.
1904.		
August 10	Just in flower	In flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	In flower	In flower with some young fruits.
September 15	Very last flowers open; no fruit dead ripe.	Very last flowers open; no fruit dead ripe.

Pusa.

	Bardwán Farm seed.	Desoál.
1906.		
August 7	Not in flower	Not in flower.
August 26	Well in flower	In full flower.
September 20	Flowering still, fruits full size	Flowering still; some fruits full size.
October 4	Some of the fruits ripe	Out of flower; a few fruits ripe.
October 21	*Plants dead ripe*	Most fruits dead ripe.
1907 (Gonhri field).		
July 23	Not yet in bud	Buds just appearing.
August 15	*In full flower*, with some young fruits.	Not yet at full flowering; some young fruits.
September 8	Plenty of young fruits	*Many fruits of full size.*
September 19	Some flowers left; much fruit	Last flowers; much full-sized fruit.
September 23	No fruits ripe yet; leaves beginning to fall.	*Just at fruit-ripening*; leaves beginning to fall.
1907 (South Pangabri field).		
July 25	Showing buds	Just coming into bud.
August 23	Almost at full flowering	Coming to full flower.
September 8	Flowers few; fruits coming to full size.	Some fruits full size.
September 23	No fruits quite ripe; *leaves falling a little.*	No fruits quite ripe; leaves not falling yet.

Race No. 14 Barapat.

Barápát (large jute) is not truly a Serájganj race, and is very little known there; for instance, in 1907, we could find no crops of it, though perhaps we saw a few plants of it mixed with Desoál, and in 1904, we only found one crop. The ryots of Serájganj if asked to

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show Barápát will point out crops of Toshá, which is **C. olitorius**, and if asked for a different Barápát will say that Kákyá Bombái is also a "bará pát."

We have now to point out the relationships of the Pabna races to the Faridpur races. The only early Faridpur race 'Aus' not having been cultivated, we have no means of comparing it with Barápát. Desoál which follows Barápát in time is shown to be earlier than Amonia of Faridpur in the following tables:—

Bardwán Experimental Farm.

	Desoál of Serájganj.	Amonia of Faridpur.
1903.		
August 2	*With very small buds*	No sign of buds.
September 10	First fruits nearly ull-sized	.....
1904.		
August 10	*In flower*	Just in flower.
September 22	Out of flower; a few fruits ripe.	Out of flower; a few fruits quite ripe.
1906.		
August 26	*Beginning to form fruits*	In flower, without formed fruits.
September 15	Very last flowers open; no fruits ripe yet.	A few flowers left; no ripe fruits.
1907.		
August 15	The very first flowers open	The very first flowers open.
September 20	Still flowering; with *very much* full-sized but unripe fruit.	Still in flower; with many fruits of full size.

Pusa.

	Desoál of Serájganj.	Amonia of Faridpur.
1906.		
August 7	Not in flower	Not in flower.
August 26	*In full flower*	Not yet at full flower.
September 20	Flowering still; some fruits full-sized.	.....
October 4	Out of flower; *a few fruits ripe*	Nof ruits ripe yet.
October 21	*Plants almost dead ripe*	.....
October 31	...	Plants not quite dead ripe.

CORCHORUS CAPSULARIS.

Pusa—contd.

	Desoál of Serájganj.	Amonia of Faridpur.
1907 (Gonhri field).		
July 23	*Buds just appearing*	Very first buds appearing.
August 15	*Not yet at full flowering; some young fruits.*	Coming into flower.
September 8	*Many fruits of full size.*	In flower with young fruit.
September 23	*Just at the beginning of fruits* ripening; leaves beginning to fall.	Fruits of full size, but none ripe: leaves beginning to fall.
1907 (South Pangabri field).		
Plots Nos. 25 and 5.		
July 25	Just coming into flower	With very first flowers.
August 23	*Coming to full flower*	Not yet at full flowering.
September 8	*Some fruits full size*	Still flowering; fruits not yet of full size.
September 23	No fruits quite ripe; leaves not falling yet.	No fruits ripe yet; leaves just beginning to fall.

Desoal of Serajganj compared with Udhap of Faridpur.

Of the Faridpur races we showed that Udhap is earlier than Amonia. As Desoál of Serájganj is likewise earlier than Amonia, it is profitable to compare it with Udhap: and on doing so we find that they are synchronous. The next table gives the results of the comparison.

The two are doubtfully distinct.

Bardwán Experimental Farm.

	Desoál of Serájganj.	Udhap of Faridpur.
1904.		
August 10	*In flower*	Just a few flowers open.
September 22	Out of flower; *a few fruits dead ripe.*	Out of flower; fruits not quite ripe.
1906.		
August 26	Beginning to form fruits	Many fruits well-formed.
September 15	Very last flowers open; no fruits ripe yet.	Last flowers open; first fruits nearly ripe.

CORCHORUS CAPSULARIS.

Pusa.

	Desoál.	Udhap.
1906.		
August 7	Not in flower	*Just in flower.*
August 26	In full flower	In flower, and *with a few fruits.*
September 20	Flowering still; some fruits of full size.	A few flowers left; some fruits just full size.
October 4	Out of flower; a few fruits ripe.	Fruits beginning to ripen.
October 10	Fruits of full size; most unripe.	Most of the fruits still unripe
October 21	Plants almost dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 25	Buds just appearing	First buds appearing.
August 15	Not yet at full flowering; some young fruits.	In flower, and with young fruit.
September 8	Much of the fruit of full size	Much of the fruit of full size.
September 23	Just at the beginning of fruit ripening; leaves beginning to fall.	Just at the very beginning of fruit ripening; leaves falling a little.

Belgachi of Madaripur is later than Desoal of Serajganj.

Belgáchi, which we found to be later than Udhap, is later than Desoál.

Bardwán Experimental Farm.

	Desoál of Serájganj.	Belgáchi of Madaripur.
1903.		
August 2	With very small buds	No sign of flowers.
September 10	First fruits nearly full-sized	.....
1904.		
August 10	*In flower*	In young bud.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	Beginning to form fruits	Beginning to form fruits.
September 15	Very last flowers open; no fruits ripe yet.	Last flowers open; plenty of nearly ripe fruits.

CORCHORUS CAPSULARIS.

Pusa.

1906.	Desoál of Serájganj.	Belgáchi of Madáripur.
August 7	Not in flower	Not in flower.
August 26	In full flower	In flower and beginning to form fruits.
September 20	Flowering still, some fruits full size.	In flower, and with fruits not quite full size.
October 4	Out of flower; a few fruits ripe.	Fruits beginning to ripen.
October 21	Plants almost dead ripe	.....
October 29	.....	Plants dead ripe.
1907 (Gonhri field).		
July 23	Buds just appearing	No buds yet on the green-stemmed plants; but a few on plants with a reddish tint.
August 15	Not yet at full flowering; some young fruits.	A very few young fruits.
September 8	*Many fruits of full size*	In flower, and with young fruit.
September 19	Last flowers; *much full-sized fruit.*	Much young fruit.
September 23	*Just at the beginning of fruit ripening; leaves beginning to fall.*	No fruit ripe yet; leaves not yet falling.

Desi is Desoál, and the name Sánchia is said to be used also for Desoál.

Race No. 5 again.

We have seen a specimen labelled Kamárjáni from Salonga in the Pabna district, and it is reported to us to differ from Desoál in possessing a slightly reddish tint on the stems. So too had the Kamárjáni of Faridpur. Apparently, Kamárjáni of Salonga is Kamárjáni of Faridpur.

Race No. 15 Kakya Bombai of Serajganj.

Kákyá Bombái is late as we saw on page 65. It is a very much praised race of Serájganj, but not nearly so abundant as Desoál.

Not uncommonly Desoál and Kákyá Bombái are sown intermixed; such crops we have examined, the Desoál being in flower and forming young fruit when the Kákyá Bombái was still flowerless. These crops must be cut when one or other of the two is not at its best, but to the ryot the mixing means this:—that if the floods rise so as to suit Desoál, it does well, if they do not, Kákyá Bombái may possibly do well and therefore in either event he gets a moderate return.

Of the Faridpur races, later than Udhap and Desoál, that we have found, and with which we may compare Kákyá Bombái, the first to consider is Amonia.

CORCHORUS CAPSULARIS.

The result of a comparison of Kákyá Bombái with Amonia is to show that the two are synchronous. But we cannot reduce them to one race, for Amonia has more constantly rosy fruits than Kákyá Bombái, and other slight differences.

Bardwán Experimental Farm.

	Kákyá Bombái.	Amonia of Pángsá.
1903.		
August 2	No sign of buds	No sign of buds.
1904.		
August 10	Not even in bud	*Just in flower.*
September 22	Still flowering; no fruits ripe yet.	*Out of flower; a few fruits quite ripe.*
1906.		
August 26	*First fruits formed*	In flower; without formed fruits.
September 15	A few flowers left; no fruits ripe yet.	A few flowers left; no ripe fruits.
1907.		
August 15	Very first flowers open	Very first flowers open.
September 20	Last flowers; with much full-sized but no ripe fruit.	Much fruit of full size, but none ripe.

Kakya Bombai of Serajganj compared with Amonia of Faridpur.

Pusa.

	Kákyá Bombái.	Amonia.
1906.		
August 7	Not in flower	Not in flower.
August 26	Not yet in full flower	Not yet in full flower.
September 20	Still flowering; fruits not yet of full size.	.....
October 4	*A few fruits ripe*	No fruits ripe yet.
October 31	.....	Plants not quite dead ripe.
November 2	Plant dead ripe	.....
1907 (Gonhri field).		
July 23	Very first buds appearing	Very first buds appearing.
August 15	*In full flower*	Coming into flower.
August 24	In flower, without young fruits.	Flowers abundant and young fruits; a few fruits of full size.
September 8	Many fruits of full size	In flower with fruit.
September 23	No fruits ripe yet; leaves not yet falling.	Fruits of full size, none ripe; *leaves beginning to fall.*

CORCHORUS CAPSULARIS.

Pusa—contd.

	Kákyá Bombái.	Amonia.
1907 (South Pangabri field).		
July 25	Buds appearing	*With very first flowers.*
August 23	Well in flower	Not yet at full flowering.
September 8	In flower; with young fruits	Still flowering; fruits not yet of full size.
September 23	No fruit ripe yet; leaves not yet falling.	No fruits ripe; *leaves just beginning to fall.*

We give next a comparison of Kákyá Bombái with the two late races of Tippera—Deodháli and Phuleswári. The three are synchronous.

Bardwán Experimental Farm.

	Kákyá Bombái.	Deodháli.	Phuleswári.
1903.			
August 2	No buds	No buds	No buds.
September 10	*With half-sized fruits*	Just in flower	Just in flower.
1904.			
August 10	Not even in bud.	*In bud*	Hardly in bud.
September 22	Still flowering; no fruit ripe yet.	No fruits quite ripe	No fruits quite ripe.
1906.			
August 26	A few young fruits formed.	In full flower	With a few young fruits.
September 15	Last flowers open; no fruits ripe.	Last flowers open; no fruits ripe.	Last flowers open; no fruits ripe.

Kakya Bombai of Serajganj is synchronous with the late Tippera races.

Pusa.

	Kákyá Bombái.	Deodháli.	Phuleswári.
1906.			
August 7	Only in bud	Hardly in flower	Only in bud.
August 26	Not yet at full flowering.	A very few young fruits.	A very few young fruits.
September 20	Still flowering; fruits not yet full size.	Still flowering; fruits not quite full size.	Still flowering; fruits not quite full size.
October 4	A few fruits ripe	A few fruits just ripe.	A very few fruits ripe.
October 21	.....	*Dead ripe*	.....
October 31	.....	.....	Dead ripe.
November 2	Dead ripe	.....	.....

CORCHORUS CAPSULARIS.

Pusa—contd.

	Kákyá Bombái.	Deodhali.	Phuleswari.
1907 (Gonhri field).			
July 23 . .	Just the first buds .	Just showing buds .	Just showing buds.
August 15 .	In full flower; with just a few young fruits.	Coming into full flower and with a few young fruits.	Coming into full flower and with a few young fruits.
September 8 .	Many fruits of full size	With much young fruit.	Much young fruit and a few of full size.
September 19 .	Fruit full sized . .	A few flowers still; much young fruit.	Most of the fruits of full size.
September 23 .	No fruits ripe yet; leaves not yet falling.	No fruits ripe yet; leaves not beginning to fall.	A very little fruit ripe; leaves not beginning to fall.

Race No. 16 Lali of Serajganj

Kàkyá Bombái is thus seen to be as late as any race.

Now the rare red-stemmed race of Serájganj remains. We found it at Serájganj to be called Láli and Náiltá by cultivators who had a stray plant here and there in their fields of Desoál: and as Náiltá it has been grown on the Experimental Farms. If we compare its behaviour with that of Desoál we get the following results :—

Bardwán Experimental Farm.

1903.	Náiltà.	Desoál.
August 2 . . .	Very small buds . . .	Very small buds.
September 10 . .	.....	Pods nearly full size.
1904.		
August 10. . .	Very young buds . . .	*In flower.*
September 22 . .	A few fruits dead ripe . .	Out of flower; a few fruits dead ripe.
1906.		
August 26. . .	In flower with a few young fruits.	In flower with a very few young fruits.
September 15 . .	*Just out of flower;* no fruits ripe yet.	Very last flowers open; no fruits ripe yet.

Pusa.

1906.	Náiltá.	Desoál.
Aug 1st 7 . . .	*Just in flower* . . .	Not in flower.
Aug 1st 26. . .	In full flower; a few plants beginning to form fruits.	In full flower.
September 20 . .	*Just out of flower;* a few fruits full size.	Flowering still; some fruits full size.
October 4 . .	Out of flower; a few fruits ripe	Out of flower; a few fruits ripe.
October 21 . .	Quite ripe	Most fruits dead ripe.

CORCHORUS CAPSULARIS

Pusa—contd.

1907. (Gonhri field.)	Nailta.	Desoál.
July 23	The very first buds appearing	Buds just appearing.
August 15	In flower, but not at full flowering.	Not yet at full flowering, with some young fruits.
September 8	With many fruits of full size	Many fruits of full size.
September 19	With fruits of full size	Last flowers; much fruit of full size.
September 23	No fruits ripe yet; leaves beginning to fall.	Fruits beginning to ripen; leaves beginning to fall.

Nailta of Serajganj is almost the same as Meghnal of Rajbari.

We find that in point of time the two are identical. The Serájganj ryots will tell any enquirer that they do not willingly get the red-stemmed Náiltá into their crops, but that a seed gets mixed here and there. We found that in crops of Desoál one plant in about 10,000 was Náiltá.

Just as Desoál is to Udhap, so is Náiltá to Meghnál.

Bardwán Experimental Farm.

1904.	Náiltá.	Nálpát or Meghnál of Rájbári.
August 10	With very young buds	Just in bud.
September 22	Some *fruits are dead ripe*	With nearly ripe fruit.
1906.		
August 26	Beginning to form fruits.	In flower, with a few small fruits.
September 15	No flowers left; no fruits ripe yet.	No flowers left; no fruits ripe yet.

Pusa.

1906.	Náiltá.	Meghnál.
August 7	*Just in flower*	Not quite in flower.
August 26	Only a few side plants have formed fruit.	A few side plants have formed fruit.
September 20	*Flowers all over; fruits full size.*	Some flowers left; fruits not yet full size.
October 4	A fair number of fruits ripe	A few fruits ripe.
October 21	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 23	The very first buds appearing	Very first buds appearing.
August 15	In flower; but not at full flowering.	Coming into full flower.
September 8	*With many fruits of full size.*	Much young fruit.
September 23	No fruits ripe yet; leaves beginning to fall.	Just at the very beginning of fruit ripening; leaves beginning to fall.

CORCHORUS CAPSULARIS.

Náiltá showed itself just a trifle earlier than Meghnál.

So-called Tosha red of Bardwan Farm was Kakya Bombai.

A so-called "Toshá red of Serájganj," which was grown at Bardwán and elsewhere in the years 1904, 1905 and 1906, really was Kákyá Bombái, wrong seed having somehow been supplied.

? Race No. 25.

We have specimens labelled Nibtá and said to be a late Serájganj race differing from Kákyá Bombái in having a red stem. We have never seen alive any **C. capsularis** so-called; but it is possibly the same as the Lál Ámon of Rangpur. We shall under **C. olitorius** speak of another Nibtá from Serájganj.

When Hem Chunder Kerr wrote his Report on Jute in 1874 apparently Desoál was the only one of the above familiar names in use in the district of Pabna, but that other races were also grown there is evident. We notice with interest from page 4 of the appendix to his report that Barápát was then both **C. capsularis** and **C. olitorius** just as it is now.

MYMENSINGH.

Proceeding to Mymensingh, we take the Jagannathganj race-names first, because that place is so near to Serájganj. There is an early race called Chhoran (or little), a race called Desoál or Dháuleswári, the names of Serájganj and Dacca mixing. Kamárjáni. Barán and Barápát.

The mart of Kamárjáni, north of Jagannáthganj we have been unable to visit ourselves; but we have caused it to be visited by one of our assistants. Its jutes —**C. capsularis** only—are Lál pát, Dháulá Aus pát, Lál Hematiyá, Dháulá Hematiyá, Bombái and Lál Karai.

On the higher land at the back of Jagannáthganj and Kamárjáni we get fewer races. About Jamálpur and Mymensingh one race prevails almost to the exclusion of others; it is Aus or Dháulá Aus; with it there are the very rarest crops of Dháulá Amon, Paknallyá, Parbatyá, and Chhotapát. From Gáiband near Kamárjáni we have obtained Lál Hematiyá and Lál Karái. At Gafargáon south of Mymensingh, we found nothing but Dháulá Aus.

The Dháulá Aus of Gafargáon and of Mymensingh is apparently the Dháulá Aus of Kamárjáni, and is the Desoál or Dháuleswári of Jagannáthganj, but differs little from the Desoál or Dháuleswári of Serájganj; lastly it does differ a little from the Parbatyá of Jamálpur as grown in the Farm Experiments.

Race No. 17 Aus of Mymensingh.

In the first place we may justify the grouping of Aus of Mymensingh, Dháulá Aus of Kamárjáni and Desoál of Jagannáthganj together. That the Aus and Dháulá Aus are the same we decided by having typical crops examined on the same day at Kamárjáni and Gáiband towards Jamálpur. That the Aus and Desoal are the same we decided by inspecting many crops on two consecutive days in 1904 about Mymensingh and Jagannáthganj.

That the Aus of Mymensingh is an earlier race than Desoál of Serájganj we see from study of the experimental plots.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm.

1903.	Aus of Jamálpur.	Desoál of Serájganj.
August 2	*Just in flower*	With very small buds.
September 10	*Fruits full size*	Pods nearly full size.
1904.		
August 10	In flower	In flower.
September 22	No flowers left; *many* fruits ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	*With some fruits of full size*	In flower with young fruits.
September 15	Very last flowers left; no ripe fruits.	Very last flowers left; no ripe fruits.

Dhaula Aus of Mymensingh is earlier than Desoal of Serajganj.

Pusa.

1906.	Aus of Jamálpur.	Desoál Serájganj.
August 7	*In flower*	Not in flower.
August 26	*A very few fruits formed*	In full flower.
September 20	A few flowers left, with fruits of full size.	A few flowers left; some fruits full size.
October 4	*Most* fruits ripe	Out of flower; a few fruits ripe.
October 17	*Plants dead ripe*	.....
October 21	.....	Most fruits dead ripe.

1907 (Gonhri field).

July 23	*Just in flower*	Buds just appearing.
August 15	*In full flower* with young fruits.	Not yet at full flowering; with some young fruits.
September 8	Much of fruit at full size	Many fruits of full size.
September 19	Most of fruit at full size	Last flowers; much fruit of full size.
September 23	*One quarter of the fruit ripe; plants losing leaves considerably.*	Just at the beginning of fruit ripening; and just beginning to lose leaves.

1907 (South Pangabri field).

Plot Nos. 20 and 25.

July 25	*Well in flower*	Just coming into flower.
August 23	*Getting past full flowering*	Coming to full flower.
September 8	*Most* fruits full size.	Some fruits of full size.
September 23	*Many fruits dead ripe*	No fruits quite ripe; leaves not falling yet.

Aus of Mymensingh and Desoal of Serajganj compared.

CORCHORUS CAPSULARIS.

This great crop—the Aus of Mymensingh—which occupies such a wide area of ground, is not selected beyond the ordinary degree. Rosy and green-fruited plants are invariably intermixed, and not considered as distinct by the cultivators. The lands it occupies are generally high-lands. On no race more constantly than this are very early fruits formed low down on the stems; but it is not a characteristic of the race to form them, but a result of grazing animals which nip off a few young plants and make them to throw out their side-shoots prematurely.

Aus of Mymensingh compared with Dacca races.

It is earlier than the Dháuleswári of Dacca.

Bardwán Experimental Farm.

1903.	Aus of Jamálpur.	Dhálsundar.	Dháuleswári.
August 2	*Just in flower*	Not in flower	Not in flower.
September 10	*Fruits of full size*	In young fruit	.....
1904.			
August 10	*In flower*	In very young bud	Just coming into flower.
September 22	No flowers left; *many* fruits ripe.	Out of flower; a few fruits ripe.	Out of flower; a few fruits dead ripe.
1906.			
August 26	*With some fruits of full size.*	Beginning to form fruits.	In flower with a few young fruits.
September 15	Very last flowers left; no ripe fruits.	The last flowers left; no ripe fruits.	A few flowers left; no ripe fruits.

Pusa.

1906.	Aus of Jamalpur.	Dhálsundar.	Dháuleswári.
August 7	*In flower*	Not yet in flower	Not yet in flower.
August 26	*A very few fruits formed.*	Scarcely any fruits formed yet.	In full flower.
September 20	Few flowers left, *with fruits full size.*	A few flowers, with young fruit.	With young fruit.
October 4	*Most* fruits ripe	A few fruits ripe	A few fruits ripe.
October 10	.....	A fair number of fruits ripe.	About half the fruits ripe.
October 17	*Plants dead ripe.*	Majority of fruits ripe	Very nearly dead ripe.
October 21	.....	Dead ripe	Dead ripe.

CORCHORUS CAPSULARIS.

Pusa—contd.

	Aus of Jamálpur.	Dhálsundar.	Dháuleswári.
1907 (Gonhri field.)			
July 23	*Just beginning to flower.*	Showing buds	Not yet showing buds.
August 16	Approaching full flowering.	Flowering plentifully.	In flower.
September 8	Much full-sized fruit	Much full-sized fruit.	With some full-sized fruits.
September 19	Full-sized fruits very plentiful.	Full-sized fruits very plentiful.	Full-sized fruits very plentiful.
September 23	*One-quarter of the fruits ripe; leaves markedly falling.*	Very few fruits ripe; leaves beginning to fall.	No fruits ripe yet; leaves beginning to fall.

Aus of Mymensingh compared with Dacca races.

1907 (South Pangabri field).

	Plots Nos. 20 and 10.		*Plot No. 10.*
July 25	*Well in flower*	...	Approaching full flowering.
August 23	Getting past full flowering.	...	Getting past full flowering.
September 8	*Most* fruits of full size.	...	Many young fruits.
September 23	Many fruits dead ripe	...	Nearly half the fruits dead ripe; leaves falling somewhat.

We may take conveniently as the next race the Chhotápát or Chhoran of Jagannáthganj, and to a small extent of Jamálpur.

Two different races have been grown at Bardwán as Chhotápát. In 1903 and 1904 the "Chhotápát" was a crop of an early green-stemmed plant, with red intermixed, the green very like Aus; but in 1906 the "Chhotápát" was a red-stemmed plant hardly differing from the Bhadya red of Jalpaiguri as grown at Bardwán. This red-stemmed Chhotápát has been grown also at Pusa. Mr. F. Smith, Deputy Director of Agriculture, Bengal, assures us that no new seed was brought in during the course of the experiments: it therefore seems as if the green-stemmed plants had been intruders, which were gradually selected out of the crops.

Race No. 18.

Taking the green-stemmed plant, we find that it behaved very like Aus, but was a little shorter. We believe that it is not truly Chhotápat.

A false Chhotapat.

Bardwán Experimental Farm.

1903.	False Chhotápát.	Aus of Mymensingh.
August 2	Just in flower	Just in flower.
September 10	Fruits full grown	Fruits full grown.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm.

1904.	False Chhotápát.	Aus of Mymensingh.
August 10	In flower	In flower.
September 22	No fruits ripe yet	No flowers left; *many fruits ripe.*

True Chhotapat compared with Aus.

The red Chhotápát, which we believe to be the true Chhotápát, compares with Aus as follows :—

Bárdwán Experimental Farm.

1906.	Red Chhotápát.	Aus.
August 26	Bearing full-sized fruits	Bearing full-sized fruits.
September 15	Last flowers left; no fruits ripe.	Very last flowers left; no ripe fruits.

Pusa.

1906.	Red Chhotápát.	Aus of Mymensingh.
August 7	*Well in flower*	In flower.
August 25	*Fruits more in number than flowers.*	A very few fruits formed.
September 20	*Out of flower*; fruits full size	Few flowers left, with fruits full size.
October 4	Plants almost dead ripe	Most fruits ripe.
October 17	Plants dead ripe	Plants dead ripe.

1907 (Gonhri field).

July 23	Just in bud	Just beginning to flower.
August 16	In flower, with many young fruits.	Approaching full flowering.
September 8	Most of fruits of full size.	Much fruit of full size.
September 23	One-half of the fruits ripe; leaves falling much.	One-quarter of the fruit ripe; leaves falling markedly.

1907 (South Pangabri field).

Plots Nos. 29 and 20.

July 25	Very few flowers	*Well in flower.*
August 15	In flower, with a few young fruits.	In flower, with young fruits.
September 8	Fruits of full size.	Most fruits of full size.
September 23	One-half of the fruits ripe; leaves falling much.	Many fruits dead ripe; leaves falling somewhat.

Chhotapat of Mymensingh is earlier than Aus.

Evidently the red Chhotápát is earlier than Aus.

Race No. 14 again.

We pass to the Barápát of Jagannathganj of the Farm Experiments. It is the same as the "Barápát of Serájganj"; for demonstration see the following table. But Barán is later.

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm.

1902.	Barápát of Jagannáthganj.	Barápát of Serájganj.	Barán.
August 28	Began to flower before Barán.	Fruits nearly full size	Began to flower about August 23.
1903.			
August 2	*Flowers just opening*	*Flowers just open*	Not in bud.
1904.			
August 10	Just in flower	Just in flower	Just in flower.
September 22	Just a few flowers left; no fruits dead ripe.	*No flowers left; many fruits dead ripe.*	Just a few flowers left; no fruits dead ripe.
1906.			
August 26	With young fruits	A fair amount of young fruit.	...
September 15	*No flowers left*; no fruits ripe yet.	Very last flowers open; no fruits ripe yet.	Very last flowers open; no ripe fruits.

Pusa.

Barapat of Jagannathganj is Barapat of Serajganj and earlier than Baran.

1906.	Barápát of Jagannáthganj.	Barápát of Serájganj.	Barán.
August 7	Just in flower	Just in flower	Just in flower.
August 26	Some plants have formed fruit.	Half the plants with fruit.	A few young fruits.
September 20	A few flowers left; fruits nearly full size.	Just a few flowers left; fruits full size.	A few flowers left; no fruits full size.
October 4	Out of flower, half the fruits ripe.	Out of flower, half the fruits ripe.	Out of flower, fruits full size, but none ripe.
October 10	.....	*Practically dead ripe*	.....
October 20	Almost dead ripe	.....	.....
October 31	.....	.....	Not quite dead ripe.
1907 (Gonhri field).			
July 23	Rare buds	Rare buds	Rare buds.
August 15	At full flowering	At full flowering	At full flowering.
September 8	Very much full-sized fruit.	Very much full-sized fruit.	Much fruit not full-sized.
September 23	A general sprinkling of ripe fruits; leaves beginning to fall.	A general sprinkling of ripe fruits; leaves beginning to fall.	No fruit ripe yet; leaves beginning to fall.
1907 (South Pangabri field).			
Plots Nos. 17, 22 and 1.			
July 25	Just in flower	Just in flower	Plants with buds.
August 23	*Past full flowering*	About full flowering	Past full flowering.
September 8	Many fruits full size	Most fruits of full size	Fruits full size.
September 23	One-quarter of the fruits dead ripe; leaves falling.	One-quarter of the fruits dead ripe; leaves falling.	A few fruits dead ripe; leaves a little falling.

CORCHORUS CAPSULARIS.

We have already shown that Barápát is a little earlier than Serájganj Desoál, and as Aus of Mymensingh is also a little earlier we may profitably compare the two.

Barapat of Jagannathganj compared with Aus of Mymensingh.

Bardwán Experimental Farm.

	Aus of Jamálpur.	Barápát of Jagannáthganj.
1903.		
August 2	Just in flower	Just in flower.
September 10	Fruits full size	.....
1904.		
August 10	*In flower*	Just in flower.
September 22	*No flowers left; many fruits ripe.*	Just a few flowers left; no fruits dead ripe.
1906.		
August 26	*Abundance of fruit; some full size.*	A fair amount of young fruit.
September 15	Very last flowers left; no fruits ripe yet.	Very last flowers left; no fruits ripe yet.

Pusa.

	Aus of Jamálpur.	Barápát of Jagannáthganj.
1906.		
August 7	*In flower*	Just in flower.
August 26	A very few fruits formed	Half the plants with formed fruits.
September 20	A few flowers left; fruits full-sized.	Just a few flowers left; fruits full-sized.
October 4	*Most* fruits ripe	Half the fruits ripe.
October 10	.....	Plants almost dead ripe.
October 17	Plants dead ripe	.....
1907 (Gonhri field).		
July 23	Just showing buds	Just showing buds.
August 16	About full flowering	About full flowering.
September 8	Most fruits full-sized	Most fruits full-sized.
September 23	*One-quarter of the fruit ripe; leaves falling much.*	A general sprinkling of ripe fruit, not quite so much as on Aus of Jamalpur; leaves beginning to fall.

Pusa—contd.

CORCHORUS CAPSULARIS.

	Aus of Jamálpur.	Barápát of Jagannáthganj.
1907 (South Pangarbi field).		
Plots Nos. 20 and 22.		
July 25	*Well in flower*	Just in flower.
August 23	Getting past full flowering	Past full flowering.
September 8	*Most* fruits of full size	Many fruits full size.
September 23	Many fruits dead ripe	One-quarter of the fruits dead ripe; leaves falling.

Barapat of Jagannathganj is later than Aus of Mymensingh and more selected.

We find Barápát to be later than Aus: and that it is a more selected and improved race. The fruits and petioles are, like the stem, almost always green, and the growth is better. In illustration of the better growth we may quote the much greater yields that Barápát has given at Bardwán than Aus.

Parbatyá of Jamálpur is the strain that we take next. Like Barápát, it is a more carefully selected crop of the Aus type such as might be a selection from Aus with the rosy-fruited plants largely eliminated. We had at one time thought it but Aus, but later investigations make us keep it provisionally distinct. **Race No. 19.**

Compared with Aus it differed in behaviour being a very little later.

We believe that the crops which are grown at Jagannáthganj in the stiller water back from the river, and may be there called Kamárjáni, are Parbatyá. They stand a little higher than Desoál, have few rosy-fruited plants in them, and are a little later.

Bardwán Experimental Farm.

	Aus of Jamálpur.	Parbatyá of Jamálpur.
1903.		
August 2	Just in flower	Just in flower.
September 10	Fruits full-sized	Fruits full-sized.
1904.		
August 10	*In flower*	In bud.
September 22	*Just out of flower;* many fruits ripe.	A few flowers left; fruits ripe.
1906.		
August 26	*Abundance of fruit, some full-sized.*	Beginning to form fruits.
September 15	Very last flowers left; no fruits ripe yet.	Last flowers; no fruits ripe yet.

CORCHORUS CAPSULARIS.

Pusa.

Two Mymensingh races compared.

	Aus.	Parbatyá of Jamálpur.
1906.		
August 7	*In flower*	Just in flower.
August 26	Very few fruits formed	Flowering; *many* young fruits.
September 20	A few flowers left; *fruits of full size.*	*No flowers;* fruits not yet full-sized.
October 4	*Most* of the fruits ripe	Half of the fruits ripe.
October 17	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 23	Just showing buds	In bud.
August 16	About full flowering	At full flowering; with a little young fruit.
September 8	*Most* of the fruits of full size	Half of the fruits of full size.
September 23	*One-quarter of the fruits ripe; leaves falling much.*	A general sprinkling of ripe fruit; leaves beginning to fall.

Parbatya of Jamalpur is not same as Parbatya of Dacca.

It is not quite the Parbatyá of Dacca which we find ourselves unable to separate from Dhálsundar.

Bardwán Experimental Farm.

	Parbatyá of Jamálpur.	Parbatyá of Dacca.	Dhálsundar.
1903.			
August 2	*Just in flower*	No sign of flowers	Not in flower.
September 10	*Fruits full size*	Fruits not quite full size.	In young fruit.
1904.			
August 10	In bud	Just in bud	In very young bud.
September 22	A few flowers left; *fruits ripe.*	No flowers left; fruits not quite ripe.	No flowers left; a few ripe fruits.
1906.			
August 26	Beginning to form fruits.	Beginning to form fruits.	Beginning to form fruits.
September 15	Very last flowers; no fruits ripe.	The very last flowers; no ripe fruits.	The last flower left no ripe fruits.

CORCHORUS CAPSULARIS.

Parbatya of Jamalpur compared

Pusa.

1906.	Parbatyá.	Parbatyá of Dacca.	Dhálsundar.
August 7	Just in flower	Just in flower	Not yet in flower.
August 26	*The number of fruits greater than the number of flowers.*	In flower, with a few young fruits.	Scarcely any fruits formed yet.
September 20	*Flowers over*; fruits not yet full size.	Flowers not over; fruits not full size.	A few flowers, with young fruit.
October 4	*Half of the fruits are ripe.*	Majority of fruits unripe.	A few fruits ripe.
October 10	.....	About half of the fruits ripe.	A fair number of fruits ripe.
October 17	*Plants dead ripe*	Majority of fruits ripe	Majority ripe.
October 21	.....	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).			
July 23	In bud	In bud	In bud.
August 16	At full flowering with a little young fruit.	In flower with a little young fruit.	In flower.
September 8	Half the fruit of full size.	More than half of the fruit of full size.	More than half of the fruit of full size.
September 19	Most of the fruit of full size.	Most of the fruit of full size.	Most of the fruit of full size.
September 23	A general sprinkling of ripe fruit; leaves beginning to fall.	A general sprinkling of ripe fruits; leaves beginning to fall.	Very few ripe fruits; leaves beginning to fall.

Race No. 20.

Barán of the Experimental Farms—later than Barápát,—was also a little later than Desoál of Serájganj.

Baran of Mymensingh compared.

Bardwán Experimental Farm.

1903.	Barán.	Desoál.
August 2	Not yet in bud	*Very small buds.*
September 10	.....	Pods nearly full size.
1904.		
August 10	Just in flower	*In flower.*
September 22	Just a few flowers left; no fruits dead ripe.	*Out of flower; a few fruits dead ripe.*

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm—contd.

1906.	Barán.	Desoál.
August 26	With a little formed fruit	With a little fruit formed.
September 15	Very last flowers; no ripe fruits	Very last flowers; no fruits dead ripe.
1907.		
August 15	The very first flowers out	The very first flowers out.
September 20	Last flowers; much full-sized but unripe fruit.	In flower, with much full-sized but unripe fruit.

Baran of Mymensingh is a little later than Desoal of Serajganj.

Pusa.

1906.	Barán.	Desoál.
August 7	*Just* in flower	Not in flower.
August 26	Not fully in flower	*In full flower*, with some young fruits.
September 20	A few flowers left; no fruits full size.	Flowering still; fruits not full size.
October 4	Out of flower; fruits full-sized, but not ripe.	Out of flower; *a few fruits ripe.*
October 21	.....	*Plants almost dead ripe.*
October 31	Plants not quite dead ripe	.....

1907 (Gonhri field).

July 23	Rare buds	Buds just appearing.
August 15	At full flowering	Not yet at full flowering; with some young fruit.
September 8	Not much full-sized fruit	*Many fruits of full size.*
September 23	No ripe fruits; leaves beginning to fall.	*Just at the beginning of fruit ripening*; and just beginning to lose leaves.

The great similarity of Barán to Kákyá Bombái must be pointed out. The differences between them are so slight that at present we unite them. Such a view is supported by the fact that the Barán of Jagannáthganj extending to Kamárjáni is there called Bombái.

In the next table Barán and Kákyá Bombái are compared.

Baran of Jagannathganj may be referred to Kakya Bombai provisionally.

Bardwán Experimental Farm.

	Kákyá Bombái of Serájganj.	Barán of Mymensingh.
1903.		
August 2	No buds	No buds.
September 10	With half-sized fruits	With half-sized fruits, *a foot higher than Kákyá Bombái.*
1904.		
August 10	Not even in bud	*Just in flower.*
September 22	Just a few flowers left; no fruits dead ripe.	Just a few flowers left; no fruits dead ripe; *a foot higher than Kákyá Bombái.*

CORCHORUS CAPSULARIS.

Bardwán Experimental Farm—contd.

1906.	Kákyá Bombái of Serájganj.	Barán of Mymensingh.
August 26	In flower, beginning to form fruits.	In flower, beginning to form fruits.
September 15	*Flowers all over ;* no fruits ripe.	Very last flowers open; no ripe fruits; the same height as Kákyá Bombái.
1907.		
August 15	Very first flowers out	The very first flowers out.
September 20	Last flowers out'; much full-sized, but unripe fruit.	Last flowers out ; much full-sized, but unripe fruit.

Baran of Mymensingh may be united provisionally to Kakya Bombai.

Pusa.

1906.	Kákyá Bombái of Serájganj.	Barán of Mymensingh.
August 7	Only just in bud	*Just in flower ;* six inches higher than Kákyá Bombái.
August 26	Not yet at full flowering	*A few young fruits.*
September 20	Still flowering ; fruits not yet full size.	*A few flowers left ;* no fruits of full size.
October 4	*A few fruits ripe*	Out of flower ; a few fruits of full size, but not ripe. *A very little* higher than Kákyá Bombái.
October 31	.....	Not quite dead ripe.
November 2	Plants dead ripe	...

1907 (Gonhri field).

July 23	No buds yet	*Rare buds.*
August 15	Well in flower with some young fruits.	At full flowering.
September 8	About full flowering	Much full-sized but not ripe fruit.
September 19	Still flowering; with young fruits.	*Most of fruits full-sized.*
September 23	No fruits ripe yet ; leaves just beginning to fall.	No fruits ripe ; leaves beginning to fall.

1907 (South Pangabri field).

Plots Nos. 8 and 1.

July 25	Beginning to show buds	Plants with buds.
August 23	At full flowering.	Plants past full flowering.
September 8	With flowers and young fruits.	Fruits of full size.
September 23	No fruits ripe yet ; plants hardly yet losing leaves.	No fruits ripe yet ; leaves not yet falling.

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Race No. 24.

We proceed now to the next race, Ámon of the district of Mymensingh, which is also called Dháulá Ámon at Jamálpur and Dháulá Hematiyá at Kamárjáni. The race is rare at all these places, and when found is generally mixed with Dháulá Aus, just as Toshá was found mixed with Desoál at Serájganj.

Race No. 21 perhaps race 16.

At Jagannáthganj there is a red-stemmed jute which occurs generally mixed with Desoál, and which is variously named as Rangi (*i.e.*, coloured) or Meghnál. It is apparently that red-stemmed plant which is commoner in the district of Bogra, and which may well be the Náiltá or Láli of Serájganj.

Very rare at Kamárjáni is Lál Hematiyá which differs from Dháulá Hematiyá in its red stem and red fruits. The names Kuchmadan (meaning not clear, but borrowed apparently from that of a red rice) and Nálpát are said by Babu N. C. Chaudhuri to be applied at Jagannáthganj to this Láli—a red counterpart of Barán. but we think from experience in the district of Bográ that they belong rather to race No. 20 just above—Rangi or Meghnál.

SYLHET.

The district of Sylhet contains in the Hábiganj subdivision the races of jute grown in Dacca and Tippera, and in the Sunámganj subdivision the races of Mymensingh. We are indebted for most of our information to Mr. H. A. Colquhoun, the Deputy Commissioner, and his subdivisional officers, Messrs. H. Moseley, H. L. Barua and N. Ahmad.

Races No. 7 and 12 again.

The commonest races in the Hábiganj subdivision are Dháuleswári and Phuleswári. With them are grown others called Bidya Sundar, Pechi and Parbatyá. Bidya Sundar is doubtless the red-

Race No. 10.

stemmed Dacca and Tippera race of that name: it is not abundantly grown; and it being apparently the only red-stemmed race of the subdivision, one sees how predominatingly green the crops are.

The identity of Pechi and Parbatyá are not to be settled without either inspecting the crops or cultivating plots from the district: and these things we have been unable to do.

The Moulvi Bazaar subdivision produces very little jute.

Race No. 17.

The Sunámganj subdivision, it seems, produces the Aus of Mymensingh and also a little red-stemmed late jute which may be

Race No. 10.

Bidya Sundar, but this is not certain. All the higher lands, given to jute, are given to Aus, or as it is generally named Ausápát. Sometimes the late race is called Ámon.

We have no more to say about Sylhet.

BOGRA.

Up the river from Serájganj and Jagannáthganj is the jute mart of Fulchári in the district of Bogra where the commonest race is

Race No. 17 again.

called Dháulápát or Dháuleswári, and besides it are Kákyá Bombái (always here Káshyá Bombái) and Nálpát. Dháulápát is also called

Race No. 15 again.

Aus, and like the Aus of Mymensingh consists of plants with both rosy and green fruits and petioles. It is either the Desoál of Seráj-

ganj or the Aus of Mymensingh, probably the latter. Káshyá Bombái is the Kákyá Bombái of Serájganj, or the Barán, of Jagannáthganj. CORCHORUS CAPSULARIS IN BOGRA.

Nálpát is apparently the Náiltá of Serájganj. It is often mixed with Dháulápát up to the extent of 50 per cent. of a crop. Race No. 21 or 16 again.

At Bogra itself the same races exist: but Káshyá Bombái is very rare. The commonest race is Dháulápát or Aus, often called Tebrá Ausia. Káshyá Bombái is at the same time called Ámon or Tebra Ámoniá; and Nálpát becomes Kuchmardan or Kuchni or Desi Meghnal. Race No. 15 again.

Dháulápát under the name of Aus extends to the extreme western edge of the district of Bogra, where we have seen it at Sántahár. There at Sántahár we found a few plants of what apparently is the Káshyá Bombái, but we could not ascertain that this name is applied to it. Race No. 17.

Hem Chunder Kerr gives nine names as in use for jute in 1874 in Bogra. His first name Joli is probably one of his many misprints and represents Jati. As this is the first district in which we meet with this rather widely distributed word, something may here be said about it. Its use extends northwards from Bogra into Assam and towards the Himalaya. It hardly expresses a race, but belongs to the species **C. capsularis** as distinguished from **C. olitorius.** Of the other eight names used by Hem Chunder Kerr, the following,—Aus, Amon, Meghlál and Kuchmardan—are in common usage there to-day and have been explained. Desi is another of his names and needs no explanation. Of the remaining three, one is Toshá which belongs to **C. olitorius** and the other two—Patnaipát (possibly an error for Madhaipat) and Numliápát—are unknown to us. The word Jati.

The district of Rangpur is to be taken next. Unfortunately we have not been able to examine carefully crops anywhere but at Rangpur itself, where the early Aus seems particularly early. These early crops are Dháulá and Nál or Lál Bitri, the latter at Rangpur being rare as a pure crop, but not uncommon mixed with the Dháula Bitri. Dháulá Aus is a name used also for this race. Dháula Bitri has been in cultivation in the Farm Experiments under the wrong name of "Bitre red"; whereas in the next table it showed itself earlier than Desoál. RANGPUR. Dhaula Bitri of Rangpur.

The crops of Dháulá Bitri at Rangpur contain both green-fruited and rosy-fruited plants. In their appearance and time of flowering, etc., they suggest Dháulá Aus of Mymensingh, with which we will now compare the race.

Bardwán Experimental Farm.

1903.	Bitri No. 29 of the Farm Experiments.	Aus of Jamálpur.
August 2	In bud	*Just in flower.*
September 10	Pods just attaining full size	*Fruits full-sized.*

CORCHORUS CAPSULARIS.

Dhaula Bitri of Rangpur compared.

Bardwán Experimental Farm.

	Bitri No. 29 of the Farm Experiments.	Aus of Jamálpur.
1904.		
August 10	In flower	In flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; *many* fruits ripe.
1906.		
August 26	Abundance of fruits formed	Abundance of fruits formed.
September 15	Very last flowers open; *a few fruits dead ripe.*	Very last flowers open; no fruits dead ripe.

Pusa.

	Bitri plot No. 29 of the Farm Experiments called "Bitri red."	Aus of Jamálpur.
1906.		
August 7	Just in flower	*In flower.*
August 26	*Nearly half of plants bearing young fruits.*	A few fruits formed.
September 20	Flowers few; fruits of full size.	A few flowers left; fruits about full size.
October 4	Most of fruits ripe	Most of fruits ripe.
October 17	...	*Plants dead ripe.*
October 21	Plants dead ripe.	.....
	Bitri plot No. 30 of the Farm Experiments.	**Aus of Jamálpur.**
1907.		
July 23	*In flower*	Just showing buds.
August 16	*Some fruits already of full size.*	About full flowering.
August 25	A few fruits of full size, but most small, and many flowers.	*Many fruits of full size;* still with many flowers.
September 8	Fruits of full size	Most fruits of full size.
September 23	One-quarter of the fruits ripe; leaves falling markedly.	One-quarter of the fruits ripe; leaves falling much.

The result of the comparison is to show there is very little difference in point of time between the two, but pending further study we are unable to unite them together into one race because they grew somewhat differently at Bardwán and at Pusa.

We need not compare Bitri with the more selected races of the river banks such as Barápát.

Nál or Lál Bitri or Lál Ausa prevails in patches within some miles of Rangpur, on the west of the Tista river, *e.g.*, near Kaunia. Nál Bitri was grown at Bardwán as No. 40 in 1903 and No. 32 in 1904, in both years wrongly called Bitri white.

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Thereafter the seed was changed, and a Dháulá Bitri was grown in its place. From the Bardwán results of those two years and from examination of the crops at Rangpur we believe Lál Bitri to be synchronous in flowering and fruiting with Dháulá Bitri.

Bardwán Experimental Farm.

Dhaula and Lal Bitris of Rangpur compared.

1903.	So called Bitri red really Dháulá Bitri.	So called Bitri white really Lál Bitri.
August 2	In bud	*In flower.*
September 10	Pods just attaining full size	Fruits just full size.
1904.		
August 10	In flower	In flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; a few fruits dead ripe.

Lál Bitri is not the Náiltá or Láli of Serájganj but something earlier.

Lal Bitri is earlier than Nailta of Serajganj.

Bardwán Experimental Farm.

1903.	So called Bitri white really red Bitri.	Náiltá of Serájganj.
August 2	*In flower*	Very small buds.
September 10	Fruits full size	.....
1904.		
August 10	*In flower*	Very young buds.
September 22	Out of flower; a few fruits dead ripe.	A few fruits dead ripe.

Race No. 24.

If anyone will go among the crops at Rangpur, he will find pure crops of Dháulá Hetiá in small number amongst the many crops of Dháulá Bitri and will have no difficulty in recognising it by its lateness. If the time be the beginning of August, Bitri and Hetiá will be of about the same height, as cases of mixing show, but Hetiá will not be in flower and will not have reached its full growth. If the field under examination be an uneven one, part above water and part water-logged, the water-logged part will be comparatively badly grown, and short compared with the drier part.

This Dháulá Hetiá is found elsewhere in small quantities about the Rangpur district, but it gives way in a most remarkable manner to Lál Hetiá along the banks of the Tista, *e.g.*, towards Lálmonir Hát, and north-westwards.

Two strains from Rangpur called Hetiá have been grown at Bardwán since 1903, and a third since 1904, and all three at Pusa for the last two years; the first called 'white' was mixed red and green,

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the red predominating, and contained both early and late plants; while the second called 'red' was green-stemmed and a genuine Hetiá; and the third was not Hetiá, but an early crop.

Dhaula Hetia of Rangpur compared.

It follows then that the second of the above, called "Hewti red" (properly Dháulá Hewti), is the only strain which we can use for comparing with other races. We compare it first with Desoál and show it just a trifle earlier than that race.

Bardwán Experimental Farm.

1903.	So called "Hewti red" really Dháulá Hewti.	Desoál.
August 2	No buds	*With very small buds.*
September 10	Flowering; with some fruits nearly of full size.	First fruits nearly of full size.
1904.		
August 10	In bud	*In flower.*
September 22	No flowers left; very *many fruits dead ripe.*	No flowers left; a few fruits dead ripe.
1906,		
August 26	With young fruits	With the first young fruits.
September 15	*No flowers left;* no ripe fruit	Very last flowers; no fruits ripe yet.

Pusa.

1906.	So called Hewti red really Dháulá Hewti.	Desoál.
August 7	*Just in flower*	Not yet in flower.
August 26	*Half the plants with young fruit.*	In full flower.
September 20	*Flowers over;* fruits not yet of full size.	Flowering still; some fruits of full size.
October 4	*Most of the fruits ripe*	Out of flower; a few fruits ripe.
October 21	*Plants dead ripe*	Plants almost dead ripe.
1907 (Gonhri field).		
July 23	*Just in flower*	Buds just appearing.
August 16	*Most of the plants with small fruit.*	Not yet at full flowering; some young fruits.
August 25	*A few* fruits full-sized	A very few fruits full-sized.
September 8	Fruits of full size	Many fruits of full size.
September 23	*A very few fruits ripe;* beginning to lose its leaves.	Just at the beginning of fruit ripening; leaves beginning to fall.

Lál Hewti stands in the same relationship to Dháulá Hewti as Lál Bitri to Dháulá Bitri.

The district of Goálpárá in its western or Dhubri end is a jute country. We have had in experimental cultivation no plots from Goálpárá; and what we have to remark rests upon our observations in the field. We have examined the crops about Dhubri and Bálájan. The prevalent crop near those places is of a green-stemmed rather early race. So prevalent is this race that many cultivators believe that it is the only race in the country-side and know it simply as "pát." But it is not the only race, for there are two others, Lálpát, which is rarely sown pure, but is a not uncommon impurity of the "Dháulápát," and "Hewti." CORCHORUS CAPSULARIS. GOALPARA.

We have also examined crops of jute at the town of Goálpárá whither cultivators from the Pabna district have brought the Serajganj Desoál and with it an odd plant or two of Kákyá Bombái: and these have been sown alongside the prevalent Dháulá Aus of Goálpárá. The Dháulá Aus at Dhubri appeared to us to be not quite so early as the Dháulá Bitri of Rangpur. From an inspection on consecutive days of the crops at the two places, we found the latter to be earlier by about ten days than the former. This might be due to climate and cultivation, but in default of experiments we consider it best to count them as separate races. They are however selected alike to the ordinary degree, both containing rosy fruited as well as green fruited plants, and to some extent pale yellow flowered plants as well as bright yellow flowered. It is very probable that this Dháulá Aus or Dháulá Bitri—it gets both names—changes gradually towards the Rangpur side into the Rangpur Bitri and southwards into the Aus of Mymensingh. Race No. 26.

This common Dháula Aus, as seen at Dhubri and Goálpárá, varies considerably in time of coming into flower, *e.g.*, it has not been selected enough to be consistent with itself even in that. It seems to extend through Kuch Behar into the Alipur Duárs. Race No. 13 again.

The Lál Bitri or Lál Aus of Goálpárá has only been seen by us as a pure crop in some five or six instances. It was almost always more advanced than Dháulá Aus, even when mixed with it in an impure crop. For this reason we suspect it of being the Lál Bitri of Rangpur, and as we have been told kindly by Babu Peari Mohan Dutt, Vice-Chairman of the Local Board at Dhubri, that seed does come into Dhubri from Rangpur this is the more probably its origin. Race No. 23 again. Race No. 23 again.

Hetiá as grown at Dhubri seems to be the same as the Rangpur Hewtia. Dháulá Haimantiá, which is the same as Hetiá, and Lál Haimantiá occur as isolated plants in the Goálpárá crops. Race No. 24.

About the town of Jalpáiguri the common jutes are green-stemmed; but red-stemmed are by no means rare. Along the Teesta southwards red jutes are more abundant, but northwards they disappear entirely. Both early and late green-stemmed plants JALPAIGURI. Race No. 25.

CORCHORUS CAPSULARIS.

are common about Jalpáiguri, towards some villages the one prevailing, towards other villages the other.

Dháulá Dhádoyá at Jalpáiguri is very seldom pure, so very seldom that cultivators are apt there to say that there is only one Bhádoya which may be green-stemmed or red-stemmed. Both green and red-stemmed have been cultivated at Bardwán and Pusa. We proceed to a comparison of Dháulá Bhádya of Jalpáiguri with Dháulá Bitri of Rangpur, in which we find that the two grown side by side are to all intents and purposes identical.

We have examined crops at Jalpáiguri and Rangpur on consecutive days, and have noted some differences, *e.g.*, that the early Jalpáiguri race seemed not quite so forward as the Rangpur races; but in the face of the evidence from Bardwán and Pusa, we do not care to declare them separate races.

The early green-stemmed crops of Jalpaiguri and Rangpur compared.

Bardwán Experimental Farm.

1903.	Dháulá Bhádya of Jalpáiguri.	Dháulá Bitri of Rangpur (called in Farm Experiments Bitri red).
August 2	*Coming into flower*	In bud.
September 10	*Fruits of full size*	Fruits just attaining full size.
1904.		
August 10	Just in flower	*In flower.*
September 22	Out of flower; a few fruits dead ripe.	Out of flower; a few fruits dead ripe.
1906.		
August 26	With young fruits	*With full-sized fruits.*
September 15	No flowers; no fruits ripe yet	Very last flowers; a few *fruits dead ripe.*

Pusa.

1906.	Dháulá Bhádiya of Jalpáiguri.	Dháulá Bitri of Rangpur (called in Farm Experiments Bitri red).
August 7	Hardly in flower	*Just in flower.*
August 26	Half the plants with young fruit.	Nearly half the plants with young fruit.
September 20	*No flowers*; fruits of full size	Few flowers left; many fruits of full size.
October 4	Most of the fruits ripe	Most of the fruits ripe.
October 21	Plants dead ripe	Plants dead ripe.
1907 (Gonhri field).		
July 23	Just in flower.	Just in flower.
August 15	About full flowering, with some small fruits.	Flowering, with *much young fruit.*
September 8	Fruits of full size	Much fruit of full size.
September 23	*One-quarter of the fruits ripe; leaves falling considerably.*	A general sprinkling of ripe fruits; leaves beginning to fall.

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Two Jalpaiguri races compared.

We next give a comparison of the Dháulá Bhádyá of Jalpáiguri with the Lál Bhádiya of Jalpáiguri to show them synchronous.

We may consider the Lál Bhádiya to be the same as the Lál Bitri.

Bardwán Experimental Farm.

1903.	Dháulá Bhádiya of Jalpáiguri.	Lál Bhádiya of Jalpáiguri.
August 2	Coming into flower	Just in flower.
September 10	Fruits full size	Fruits many, full size.
1904.		
August 10	Just in flower	Just in flower.
September 22	Out of flower; a few fruits dead ripe.	Out of flower; some fruits dead ripe.
1906.		
August 26	Forming fruits	With full-sized fruits.
September 15	Flowers all over; no fruits ripe yet.	Flowers all over; no fruits ripe yet.

Pusa.

1906.	Dháulá Bhádiya.	Lál Bhádiya.
August 7	Hardly in flower	Hardly in flower.
August 26	Half the plot with young fruit	Nearly half of the plot with young fruit.
September 20	Out of flower; fruits full size	Out of flower; fruits full size.
October 4	Most of the fruits ripe	Most of the fruits ripe.
October 21	Plant dead ripe	Plant dead ripe.
1907 (Gonhri field).		
July 23	Just in flower	With buds.
August 10	About full flowering but with some fruits of full size.	Much small fruit.
September 8	Fruits full size	Fruits full size.
September 23	One-quarter of the fruits ripe, leaves falling considerably.	One-half of the fruits ripe, plants losing their leaves very greatly.

We have already compared Dháulá Bitri with Aus of Mymensingh and found them synchronous: it is therefore to be expected, as Lál Bhádiya is synchronous with Dháulá Bhádya which is Dháulá Bitri, that tables will show Lál Bhádyá to be synchronous with Aus. We give these tables next. Our reason in including them is that we have subjected the Lál Bhádiyá to some selection, and it is the

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selected Bhádiyá which, grown on the Pangabri field at Pusa, is compared with Aus in the last part of the tables:—

Bardwán Experimental Farm.

1903.	Dháulá Bhádiya of Jalpáiguri.	Aus of Jamálpur.
August 2	Coming into flower	Just in flower.
September 10	Fruit full size	Fruit full size.
1904.		
August 10	Just in flower	*In flower.*
September 22	Out of flower; a few dead ripe	Out of flower; *many* fruits ripe.
1906.		
August 26	Forming fruits	Bearing full-sized fruits.
September 15	*Flowers all over*; no fruits ripe yet.	Very last flowers left; no fruits ripe yet.

Pusa.

1906.	Dháulá Bhádiya of Jalpáiguri.	Aus of Jamálpur.
August 7	Hardly in flower	*In flower.*
August 26	Half the plot with young fruit	A very few fruits formed.
September 20	Out of flower; fruits full size	A few flowers left; fruits full size.
October 4	Most of fruits ripe	Most of fruits ripe.
October 17	.....	Plant dead ripe.
October 21	Plant dead ripe	.....
1907 (Gonhri field).		
July 23	Just in flower	Just showing buds.
August 16	About full flowering, but with some fruits of full size.	About full flowering.
September 8	Fruits of full size	Most fruits of full size.
September 19	A few fruits ripe	Most fruits of full size.
September 23	One-quarter of the fruits ripe; leaves falling considerably.	One-quarter of the fruits ripe; leaves falling much.
1907 (South Pangabri field). *Plots No. 12 (being a selected strain) and 20.*		
July 25	Coming into flower	Some plants in flower.
August 15	In flower with some young fruits.	Just about full flowering.
September 8	With full-sized fruits	Much full-sized fruit.
September 23	Half of the fruits ripe; leaves falling much.	A fair amount of ripe fruit; leaves falling somewhat.

CORCHORUS CAPSULARIS.

Lál Bhádiyá of Jalpáiguri then is to be counted the same as Lál Bitri of Rangpur. We have received a specimen from Jalpáiguri called Kharia which is apparently this. Race No. 23 again.

Hewtiá of Jalpáiguri consists of a green-stemmed and a red-stemmed race, the latter being the most abundant of all jutes on the banks of the Tista, opposite the town of Jalpáiguri, but the former abundant west of Jalpáiguri and in the Pátgrám subdivision. We are as nearly assured as it is possible to be by inspection of crops, but without experimental cultivation, that these Hewtias are the same races as are found in Rangpur. Races Nos. 24 and 25 again.

DARJEELING TERAI.

In the Darjeeling terai the chief race is Dháulá hewti (there called Dháulá Haimantiá), which gets more and more abundant as we go further and further from Jalpáiguri, while the red jute, Lál Bhádiyá, gets scarcer and scarcer, until at Siliguri there is only a very little of it indeed. Race No. 24.

Very sparingly in the Darjeeling terai also occur Lál Haimantiá, which is Lál Hewti, and Dháulá Bhádiya. Race No. 25.

The jutes that occur west of Jalpáiguri have not been in cultivation at all, but by touring through the districts and by the kind help of the officers stationed in them, we have obtained the race names in use, and have been able to group them into the following table :— Race No. 22.

		Darbhanga.	Purneah.			
			Forbesganj.	Purneah.	Kissenganj.	Bársoi.
Early	Jut pát	...	Desi patwá or San patwá.	Sanpatwá.	Dhámar.	Bhádyá.
	...	...	Lál patwá.	Meghnál.	Lál Dhámar, Meghnal.	Meghnál.
Late	...	...	...	...	...	Dháulá Hewtiá.
	...	...	...	...	...	Lál Hewtiá.

	Dinajpur.					
	Ráiganj.	Gangarám-pur.	Dinájpur.	Parbati-pur.	Náwáb-ganj.	Thákurgáon.
Early	Dháulá Bhádyá.	...	...	Bhádyá.	Dháulá Bhádyá.	Dháulá Bhádya or Dhamar.
	Meghnál.	Meghnál.	Bhádyá.	Meghnál.	Meghnál.	
	...	...	...	...	...	...
Late	Hewtiá.	Hewtiá.	Haimantiá.	...	Hewtiá.	Hewtiá.
	...	...	...	...	...	...

DINAJPUR.

We are particularly indebted for help to Mr. J. Vas, I.C.S., who, when Collector of Dinájpur, obtained for us information from the outlying places in his district which we have not visited.

In parts of the Dinájpur district red-stemmed jutes greatly prevail, the common one being an early red called Meghnál or Meghlál, while the early green-stemmed seems to be absent. Then Race No. 23.

CORCHORUS CAPSULARIS.

Race No. 22.

again in other parts red-stemmed disappear entirely before the green-stemmed races. A consecutive examination of crops at Dinájpur, Parbatipur and Jalpáiguri led us to consider the Dhálá Bhádyá in all three places as one race, and the same applies to Lál Bhádyá. The Hewtia or Haimantiá also of the first and last places is apparently one race.

At Parbatipur the crops are about 80 per cent. of a mixture of the two Bhádyas, 10 per cent. of Dháulá Haimantiá and 10 per cent. of **C. olitorius**. At Dinájpur red Bhádyá prevails. We believe that this is also the case at Thákurgáon, but we have no precise information.

PURNEAH.

Races Nos. 22, 23, 24 and 25.

In the district of Purneáh at Bársoi green-stemmed crops are prevalent, but it is very common for the two Bhadiyas to be grown mixed. All four,—Dháulá Bhádiyá, Lál Bhádiyá or Meghnál, Dháulá Hewti and Lál Hewti—are grown at Bársoi. At Kissenganj the crops are better than at Bársoi, and the green-stemmed early plant there called Dhámar is believed by many to be a different race from the Dháula Bhádiyá with which we have been dealing. It may be so; but we have not experimental evidence.

Races Nos. 22 and 23 or possibly races apart.

The only other race that we discovered near Kissenganj was a tall red-stemmed early jute called Lál Dhámar, which, if Dhámar is a race apart, is also a race apart, but of that we have no evidence.

At Purneáh, Dháulá Bhádyá and Lál Bhádyá are grown as at Kissenganj under the names of San patwá and Meghnál, and again at Forbesganj; but at Forbesganj there is really little but San patwá.

Races Nos. 22 and 23.

At Aráryá the word Hewti become Hetwá, perhaps on account of the similar sound of the word 'patwa'.

It is interesting to observe that at Forbesganj on the edge of the Nepál terái as in the Darjeeling terái a green-stemmed race is almost the only one grown. During the examination of many crops at Forbesganj we found a few dozen plants of Dháulá Hewti which had come in by accident, and which we take as evidence of the importation of seed.

The Bengal Government has established a seed improvement station at Purneáh, and there we examined crops of Serájganj Desoál and Kákyá Bombái. It was evident to us that the common jute of that country side is about 7—14 days earlier than Desoál, and of course much earlier than Kákyá Bombái.

BHAGALPUR.

In the district of Bhagalpur, there is a little jute produced in the northern subdivisions doubtless of such races as are grown in neighbouring parts of the district of Dinájpur.

DARBHANGA.

The most western jute crops known to us and not sown by planters are those near Ujiápur on the western part of the district of Darbhangá. The plant seems to correspond with Dháulá Bhádyá of Jalpáiguri.

CORCHORUS CAPSULARIS.

MALDA.

In the district of Máldá, as in Purneáh, jute is called Patwá, and **Hibiscus cannabinus** is called Amlá patwá; but jute in Máldá has only recently become a crop of any importance: formerly **Hibiscus cannabinus** was almost the only one of the two cultivated, but now it is not quite so abundantly grown. The cultivators except along the Ganges banks opposite Rájmehál know little of jute; the settled Santális do not grow it, and the Bengali Mohammedans, though they have recently grown a lot of it, have scarcely appreciated that there are different races of it. The crops again—with the exception of those on the Ganges churs, etc., opposite Rájmehál—are very much mixed,—early green-stemmed, late green-stemmed, early red-stemmed and late red-stemmed all being evident in most, together with intermediates that cross-fertilisation has produced. Never except opposite Rájmehál have we seen a pure crop, although in some crops the early element prevails and in some the late; and although some crops have more green-stemmed plants than others, and some have more red-stemmed. Not a few cultivators recognise red and green as characters of distinct races and sometimes they have an uncertain idea that one is better than that other; and perhaps sometimes a cultivator who picks his seed early, gets in consequence a predominance of early plants in the next crop; but that is by a chance only. Of recent years a good deal of seed has been carried from village to village by men anxious to try the crop.

Origin of mixed crops of Malda.

We think that but little seed has crept into Máldá from the Purneáh and Dinájpur districts; but much has come from Rájsháhi, mixed already as we see it in Máldá: and this mixture of earlier and later, reds and greens, is giving rise to a liberal supply of intermediates whereby the four extremes are being drawn closer together. We may call the mixture the Máldá mixed crop. In some places near English Bázár it was seen on a very heavy jheel soil and was not nearly so well grown as on higher land.

Nos. 13 or 1 and 2.

Nos. 15 and 24.

We found that in this mixture the Mohammedans near Máldá recognise the green-stemmed under the name of Dudhsár (milky), and the red under the name of Lál patwá (red jute) or Meghnál: they also use loosely the word Sánchia (n very faintly sounded) as more or less synonymous with Patwá, so that **C. capsularis** becomes Tita Sánchia and **C. olitorius** Mitha Sánchia. Only in a few crops near English Bazar was selection of seed really evident: several of these were of late red-stemmed, and one was of early green-stemmed. But near Muhipur, the crops were more predominatingly green, and on the low land at the intake of the river Máhánanda opposite Rájmehál the crops were approximately pure green-stemmed or approximately pure red-stemmed: and they were well grown. The cultivators of these are settlers from the Nadia district who are well accustomed to fairly good jute, and it is said that they procured their seed from down the river.

CORCHORUS CAPSULARIS.

According to Hem Chunder Kerr (page 16 of his Report) a jute called Muniasi was, in 1874, grown in Máldá together with a Náltá patwá. Náltá patwá is most likely one of the elements of the Máldá mixture, while Muniási is the pot-herb to be mentioned later on—page 104.

SONTAL PERGANNAHS.

The Máldá mixed crop is grown at Rájmehál and other places southwards between the Sontál hills and the river, especially on land a little raised above that given to the transplanted rice. Crops examined at Rájmehál were seen to have undergone a little selection in different ways; so that one might be predominatingly early and contain both red-stemmed and green-stemmed plants; another late but similarly with both red-stemmed and green-stemmed plants; while a third might be found red-stemmed entirely but containing both early and late plants.

BIRBHUM.

At Nálháti two small crops that we examined contained every one of the forms early and late, green and red, but in unequal proportions, so that in one red predominated, and in the other green.

RAJSHAHI.

In the district of Rájsháhi jute is, by a very little, better understood than in the greater part of the district of Máldá: that is to say, though at Rámpur Boáliá the mixture of races occurs as in Máldá, it becomes more common, especially east of Rámpur Boáliá, to grow crops in which early or late more strongly predominate, and as far east as Nattor we have seen nearly pure crops of early red and late green, while within a few miles of Rámpur we have seen a pure crop of late red-stemmed. At Rámpur Boáliá Meghlál is the name used for both early and late red-stemmed **Corchorus capsularis.** The green is often called Sánchia or Dhálá Sánchia.

Race No. 2.

Nos. 16 and 25.

We find much more **C. olitorius** in the district of Rájsháhi than in the district of Máldá; but to this plant we shall turn later.

MURSHEDABAD.

The district of Murshedabád adjoins the Sontál Pergannahs and faces the district of Máldá. In it, on the Ganges banks at Lálgolá, there are very wide stretches of **Corchorus capsularis,** all the four—early and late, green and red being present;—but a considerable effort has been made to keep the red out; so that the crops are predominatingly green, and chiefly they are late green.

The cultivators of Lálgolá are ignorant of the possibilities of races being early or late; and they call all their green-stemmed **Corchorus capsularis** by the name of Dudhsár or Dudhshár, and they call all the red Meghnál. The early red we may now identify: it is the pure early red strain found in the crops of Máldá, the Sontál Pergannahs, and Rájsháhi; which we found pure at Nattor, and pure again at Poradáha in the Nadiá district.

Race No. 16.

Berhampur is more in a region of **Corchorus olitorius** than of **C. capsularis,** but both species are present, though the better cultivators apparently have hitherto been in the habit of growing the first only. We have seen a few good crops of the second, and they are a new adventure. That good crops of **C. capsularis** can be grown is shown by the way in which one of Desoál has been produced in this year (1907) on the new jute seed farm near Berhampur. CORCHORUS CAPSULARIS IN MURSHEDABAD.

South of Berhampur red crops are markedly preferred, and we find small patches of pure red **C. capsularis** here and there near the very limit of the district. The cultivators call the plant Tepári (meaning round) or Bhutkori (meaning ghost's cowries). The latter quaint name we thought when we first heard it near Berhampur to be spurious, but when next day at Palási, seventeen miles away, it was again used to us, and when later under the spelling of Botocari we recognised it in Hem Chunder Kerr's report as in use in Birbhum, it was obvious that we had to accept it, Tepári or Bhutkori the cultivators know to occur in two forms Lál (red) and Dháulá (green)—Lálpát and Dháulapát:—the two we found mixed at Berhampur, but we did not see the green south of Berhampur, it being apparently very rarely grown. Race No. 16. Race No. 13.

It is worth the remark in passing that local prejudices in favour of green or red are nowhere so strongly contrasted as in the district of Murshedabád. One may enter it at the south end where there is nothing but red-stemmed jute, and pass by some thirty-five miles of railway to Lálgolá in a region where red is discredited and the whole country side is covered with crops from which the ryots try to eliminate it. Let it be said, despite whatever the cultivators believe, that no one has yet proved that red-stemmed plants give stronger fibre than green-stemmed, or whiter fibre than green-stemmed, or more fibre, or ret quicker or more evenly, or that the reverse is the case. Experiment will now be turned to this, and not only will one point of economic interest be touched on thereby, but the scientist may find facts at the same time, which bear upon the value in the plants' economy of the red tints that nature provides so freely.

In the district of Nadiá which comes next we approach Faridpur again. With the exception of the south banks of the Ganges the whole district is a region of **C. olitorius**, and in the centre and much of the south there is little else. About Palási we find sparingly the Tepári or Bhutkori mentioned just above; other crops to the extent of 90 per cent. are red **C. olitorius**. In the north, we have studied the crops at Poradáha, where about 70 per cent. of them are of **C. olitorius** and 30 per cent. of them **C. capsularis.** Of **C. capsularis** we there found an early green race, an early red race, and a late green race, but NADIA. Race No. 16.

CORCHORUS CAPSULARIS. Race No. 2.

these were often rather mixed together. One of the first crops examined, for instance, was late green-stemmed with, scattered through it, isolated plants of early red-stemmed **capsularis**; another was of early red-stemmed with a few plants of early green intermixed and a certain number of intermediates. The late green race bears the name of Amonipatti, and the early green race may be called Dháleswar.

Races Nos. 17 and 13.

No crops of **C. capsularis** were found by us in the district at any other place, though we have been informed that there are some in the Chuádángá subdivision and also a few towards Nadiá town, which are called Sadu or Paturi, and that a race called Kamárjáni is grown at Kushtea.

As far as we can tell the early reds of Poradáha and Palási in Nadiá, of Nattor in Rájsháhi and in the mixed crops of Rámpur Boáliá, Máldá, Rájmehál, etc., are all one race, and probably it is the Láli of Serájganj. The early green which is present through the districts of Nadiá, Murshedabád, Rájsháhi, Máldá and into Birbhum and the Sontál Pergannahs may be a westward extension of Desoál of Serájganj or Aus of Faridpur or of both, and perhaps also of Kamárjáni. The late green which is so prevalent at Lálgolá and is abundant at Poradáha is very probably Amoniá of Faridpur and the late red of Poradáha, Palási, Rámpur Boáliá, and mixed everywhere in the Máldá mixed crop is probably the same as the Nibtá of Serájganj which is our No. 25. It may not be justifiably separated from the Meghnál of Faridpur, but so far as our evidence goes, Meghnál of Faridpur is a little earlier; and it is better to err at present on the side of too much 'splitting' than on the side of too much 'lumping':—we keep it as Race No. 25, while Meghnál of Faridpur is race No. 6.

Race No. 16. Race No. 11 or 1.

Race No. 2.

Race No. 25.

JESSORE.

In the Jhenidáh subdivision of Jessore are grown races of jute called respectively Kamárjáni, Deshi and Sáda. Kamárjáni seems to be the same as the Faridpur Kamárjáni. How the names Deshi and Sádá are applied we do not quite know. In the south of the district we get very little **C. capsularis**, and what there is, is known simply as Sáda titá pát, being a green-stemmed race, and apparently the same as that so called in the neighbourhood of Calcutta.

Race No. 5.

Race No. 26.

KHULNA.

On the south of Jessore in the district of Khulna we are within the region where **Corchorus capsularis** almost entirely gives place to **C. olitorius**. The races of **capsularis** in Khulna are reported to us to be called Chattua and Deshi; we do not exactly know how the names are applied.

TWENTY-FOUR PERGANNAHS AND HOWRAH.

In the 24-Pergannahs, **C. capsularis** is chiefly called Tita pát: but Lanka gori, Himatpát, Hematgár, Kosta pát, Sanchi pát and Bominál are other names that we find in use. The old name of Ghi-nalita-pát which Voigt used in 1844 (Hortus Suburbanus, page

127) and which is quoted in U. C. Dutt's Materia Medica of the Hindus is rarely used now. Sádá titá pát, Sádá lanká gori, Himat pát or Hematgár all belong to an early green-stemmed race; Lál titá pát and Lál lánká gori both belong to an early red-stemmed race found generally in small quantity mixed with the Sádá titá pát and but rarely purposely cultivated. Hem Chunder Kerr's Sanchi ranga pát may well be the same red-stemmed race. His name Bugnal pát suggests Boginál or red bogi. The name bogi we know to belong to **C. olitorius**. The origin of the name Lanká gori is not clear; lanká means a chillie; but if the name were connected with that, it would only seem applicable to a red-stemmed race, and sádá lanká gori would hardly be reasonable. CORCHORUS CAPSULARIS.

Sádá titá pát begins to flower before July is out. On some sides of Calcutta, particularly the west, there is none of it, all the jute being **C. olitorius**, but on others it is fairly plentiful. It is grown at intervals all the way down to Port Canning.

Lál titá pát is the exact counterpart of Sádá titá pát.

A late race had been seen by us in a small plot on the south of Calcutta, where the name Bomi was wrongly applied to it. It is apparently something brought in from another district. Race No. 27.

There is a very little Tita or Teto pát in the Hughli district. HUGHLI.

In the parts of the district of Midnapur, which adjoin the districts of Howrah and Hughli, cultivation of jute is much as in those two districts. **C. capsularis** is there called Titá pát and Hanumán pát. We do not know how Hanumán pát is distinguished from Titá pát, but in the Tamluk subdivision we believe that a difference is recognized. In the Contai subdivision the nature of the jute crops is somewhat different, and the names are quite different. **C. capsularis** is called either Koshta or Jhot-pát. It may be green-stemmed or it may be red-stemmed: if red-stemmed, the adjective lál is prefixed to the word Koshtá or to the words Jhot-pát. There is said to be a difference between Jhot-pát and Koshtá, but that difference has not been studied by us on the spot. Koshtá is said to grow taller than Jhot, to give fibre not quite so lustrous, and not to be grown as Jhot is for the leaves which are dried to be used as a fever medicine. If as is said in a report by Mr. N. Bagchi, Subdivisional Officer of Contai, sent to us, that Koshta grows as high as Baitri, which is **C. olitorius**, it is probable that not it but Jhot is the Titá pát of the 24-Pergannahs. The other two races from Midnapur are then apparently the same as the two Orissa races to follow. MIDNAPUR. Jhot possibly Races Nos. 26 and 27. Probable Races Nos. 28 and 29.

Lastly we come to the jute of Orissa. Nalita, a word very near to the Sanskrit Nádika, is the name adopted there for the jute plant, and the common name for **C. capsularis**, *viz.*, Pita nalita, is of course in meaning equivalent to the Titá pát of the neighbourhood BALASORE. CUTTACK.

CORCHORUS CAPSULARIS.

of Calcutta. Of Pitá nalitá we have green and red-stemmed races, grown in not very pure crops. Of the green-stemmed race, some plants have green fruits and petioles, and others rosy fruits and petioles. It is far more abundant than the red-stemmed race. The red-stemmed may be called Nala pitá nalitá and the green-stemmed Dháulá pitá nalitá or Deotá pát. In one spot we found a later crop, red-stemmed, called to us Bará pát.

Race No. 30.

To ascertain absolutely the relationship of these three Orissa races to those north of them is not possible, as they have never been cultivated by the side of others, but we observed that the early races seemed synchronous with the races of Calcutta.

Provisionally. Races Nos. 28 and 29.

The late green-stemmed race has not been studied in cultivation, and we leave it with the provisional number 30.

C. capsularis grown for eating.

COMESTIBLE CORCHORUS CAPSULARIS.

Before leaving **C. capsularis** for **C. olitorius**, it is necessary to mention sundry races of the plant grown for eating, and not for fibre.

Race No. 31.

In the first place, there is an extraordinary race known as Chira or Muniási at Purneáh and Kissenganj, a plant only found in gardens, which has long very much toothed leaves, and attains a no greater height than about two feet: the stem is very red. What we believe to be exactly the same has been collected by Mr. D. Hooper, on a forest clearing—a Tipperah jhum—at Hazarikhil in the Chittagong district. The local use was not ascertained, but as it was only three feet high, it seems probable that it is a vegetable, and not a fibre plant. This race was long ago found by Buchanan Hamilton to be used as vegetable in Rangpur under the name of Marua. In a paper published in the Journal of the Asiatic Society of Bengal, 1907, p. 633, we call it **C. capsularis**, var. **Marua.**

Races Nos. 32 and 33.

Different from this race is the Chirá-mirá or Chiruá or Miruá of Jalpáiguri which in two forms — green-stemmed and red-stemmed — is to be seen in gardens about that town. It is a very well-known vegetable there, and when found is seen, unless too young, to have been plucked over for its tender shoots. These shoots are not bitter. The Jalpáiguri Chirá-mirá grows three feet high, and has shortly ovate leaves very distinctly rounded below. Red-stemmed and green-stemmed seem equally in favour. The plants seem to flower earlier than the Jalpáiguri Bhádoya—in fact as early as any jute. Hem Chunder Kerr (Report on the Cultivation of, and Trade in, Jute, 1873, page 15) names a Chiral naricha from Dinájpur which may well be the same as Chirá. The second half of the name is curiously like the word Narish, which (page 16) he says belongs to jute in the Chittagong hill tracts. We have named this comestible jute **C. capsularis**, var. **pyrifolia**.

COMESTIBLE CORCHORUS CAPSULARIS.

A third comestible jute we obtained in Jalpáiguri under the same names as the last, and we have named it **C. capsularis,** var. **corylifolia** on account of the shape of its leaves. They are cordate, and very distinctly doubly serrate, with the main nerves as in var. **Marua,** radiating from the base.

We have only seen these three pot-herb races, and only from the places named; but **C. capsularis** is grown elsewhere for food (*vide* Hem Chunder Kerr's Report, page 22, where the districts of Bankura, Birbhum (thana Bissenpur), Sibságar and the Chittagong hill tracts are mentioned as places where this is the case. The leaves of the bitter races are used widely in Bengal in the form of an infusion as a fever medicine or placed a few into the daily food under the belief that they ward off fever.

Corchorus capsularis wild or run-wild.

WILD CORCHORUS CAPSULARIS.

Corchorus capsularis has been seen by us or is recorded as wild (run-wild generally) from a number of places outside the jute-growing area.

Upper India and Gujarat.

Edgeworth in the Journal of the Asiatic Society of Bengal, xxi., 1853, page 27, mentions it as in fields in the Bánda district. Duthie records that he obtained specimens from Bundelkhand and Rohilkhand. The locality in Rohilkhand is recorded in the Dictionary of Economic Products, paragraph C, 1847, by Sir George Watt, as Judalpur on the banks of the Gumpti river: Judalpur in the district of Sháhjehánpur is intended, and some of the specimens (which were obtained by Duthie's collector Harsukh) seen by us were only two feet high; they were called Harrua or Harrawa. Stewart (Punjab Plants, 1869, page 26) said that it was not unknown in the wild state in the Punjab. Someone, name not recorded, collected at Harduár specimens of it which are preserved in the Royal Botanic Gardens, Calcutta. It is recorded by Atkinson (Account of North-Western Provinces, India, iv., page lxix.) as growing in the Agra division. The late Mr. C. Maries collected it at Gwálior. It was seen by us at Chharodi, west of Ahmedabád, five feet high as a weed on the edge of a juar field, in 1903. We have seen it from Surat. We have seen it to the north of Bombay near Bassein at Nalá Sopárá and Nirmal. It was common round a jheel at the latter place on bunds in 1905. In 1902 it was in a garden and near it at Nalá Sopárá.

Bombay.

Deccan.

It occurs in the Deccan at Poona. In the Bombay Gazetteer, xv., 1883, page 428, is included a list of the plants of North Kanara by Talbot, who mentions **Corchorus capsularis** as found sparingly on roadsides throughout the district, and we have received it from South Malabar. Lawson collected it at Madras.

WILD CORCHORUS CAPSULARIS.

Chutia Nagpur.

On the Chutia Nágpur plateau it is rarely to be found; the late Mr. C. B. Clarke collected it at Ranchi in 1873, the Rev. A. Campbell sent it to Calcutta from Pokhuria under the Santáli name of Kashom ran. Mr. Campbell's specimens by their rounded leaves look very like the Jalpáiguri Chira-Mira.

Assam.

Mr. C. G. Mackenzie Kennedy, Deputy Commissioner of Nowgong, in 1897, sent to the Reporter on Economic Products specimens of this jute which had been found wild, stunted, and which were confused under the name of Chaká-márá with **Melochia corchorifolia.** No fibre is extracted from either it or Melochia in that district. Chakámárá is the same word etymologically as Chiramira and the second half of it as Máruá, which belongs also to **Corchorus olitorius.** It has been seen by us in a very branched condition from Tingalibam in the district of Sibságar.

Masters recorded in 1848 that it was in the Angami-Naga hills (Journ. Agric. Hort. Soc., India, vi., page 41).

Burma.

Kurz in his Contributions to a Knowledge of the Burmese Flora, page 130, says that **C. capsularis** is cultivated all over Burma. We have seen specimens which he collected on the Southern Yomas; and we have found it ourselves at Kyauktaga in Pegu, at Kamahat near Bhamo and at Myawadi in the Amherst district on the Siamese frontier. It was wild in each of these places, and at Myawadi fibre was said to be made from it by hand-stripping without retting.

Malay Peninsula.

Still further south it occurs in Perak, whence various collectors have obtained it. Ridley (Malay Plant Names, in Journ. Roy. Asiatic Soc., Straits, 1897, page 257) gives a Malay name for it, *viz.*, Sunarong betina. It occurred wild in the morass of Parang in Java about 1820 and had been cultivated in other Malay Islands as long ago as the time of Rumpf., 1653—1702. It further occurs in cultivation in Formosa (*vide* Matsumura and Hayata in Journ. Coll. Science, Tokyo, xxii, p. 64).

The way the plant grows in these widely separated localities indicates how easy of cultivation it is. It is the need of stagnant water for retting which has limited the area over which it is cropped; and it is the abundance of jheels which has caused superior races to be selected in the jute centres along the backwaters of the great rivers of the Bengals.

REVIEW OF DISTRIBUTION OF RACES.

It is now well to put into the form of a table our results. We give them district by district, using capital letters for races which are very common and using italics for red-stemmed races. The table follows, early races to the left, and late races to the right. It has been a matter of some debate with us whether Dhaleswari No. 7 should be reckoned as mid or late: it is later than Udhap. but earlier

than Deodháli. We have decided to count it as late in this table, but it would not be wrong to count it as mid.

Faridpur	Aus No. 1	.....	.....
			AMON No. 2.
		UDHAP No. 4	SUTPAT No. 3.
			.....
		Meghnal No. 6	*Belgachi* No. 5.
			.....
			[Parbatya No. 7.]
Bakarganj	.....	.....	PECHI-PAT No. 8.
		Shonamukti No. 6	
Dacca	.....	.....	DHALESWARI No. 7.
			KAJLA No. 8.
			Bidya Sundar No. 10.
			Desi No. 9.
			Belgachi No. 5.
Tippera	.....	.....	DHALESWARI No. 7.
			Kajla No. 8.
			Bidya Sundar No. 10.
			Deodnali No. 11.
			Phuleswari No. 12.
Pabna	.....	DESOAL No. 13	.....
	Barapat No. 14	.....	.....
		Lali No. 16.	.....
			KAKYA-BOMBAI No. 15.
			Nibta ? No. 25.
Mymensingh	AUS No. 17	.....	.....
	Chhotapat No. 18	.....	.....
	Barapat No. 14	.....	.....
		Parbatya No. 19	.....
			Baran No. 20.
			Amonia No. 24.
		Rangi No. 21	
Bogra	DHAULAPAT No. 17.	.....	.....
		Nalpat ? No. 21	.....
			Kashya Bombai No. 15.
Rangpur	DHAULA BITRI No. 22.	.....	.....
	Lal Bitri No. 23	.....	.....
		.....	Dhaula hetia No. 24
		.....	*LAL HETIA* No. 25.

CORCHORUS CAPSULARIS. REVIEW OF DISTRIBUTION OF RACES.

Goalpara	DHAULA AUS No. 26.	.....	.....
	.....	[Desoal No. 13].	.....
	Lal aus No. 23	.....	.....
		.....	Dhaula hetia No. 24 or haimantia.
		.....	*Lal haimantia* No. 25.
Jalpaiguri	Dhaula bhadoya No. 22.	.....	.....
	Lal bhadoya No. 23.	.....	.....
		.....	Dhala heotia No. 24.
		.....	*LAL HEOTIA* No. 25.
Darjeeling terai	Dhaula bhadoya No. 22.	.....	.....
	Lal bhadoya No. 23.	.....	.....
		.....	DHALA HAIMANTIA No. 24.
		.....	*Lal haimantia* No. 25.
Dinajpur	DHAULA BHADYA No. 22.	.....	.....
	MEGHNAL No. 23.	.....	.....
		.....	Heotia No. 24.
Purneah	SAN PATWA No. 22.	.....	.....
	Meghnal No. 22	.....	.....
		.....	Dhala heotia No. 24.
		.....	*Lal heotia* No. 25.
Malda, Sontal Pergannahs and Birbhum.	.....	Dudhsar ? No. 13	.....
	.....	*Lal patwa* No. 16	*Lal patwa* ? No. 25.
Rajshahi	.....	Dhaula Sanchi No. 13.	Dhaula Sanchi No. 2.
	.....	*Megh lal* No. 16	*Megh lal* No. 25.
Murshedabad	.....	DUDHSAR No. 13.	Dudhsar No. 2.
	.....	*Meghlal* No. 16	*Meghlal* No. 25.
Nadia	.....	Aus No. 13.	.....
	.....	*Kuchmadan* No. 16.	.....
			AMON No. 2.
	.....		*Meghlal* No. 25.
24-Pergannahs	.....	Sada tita pat No. 26.	.....
	.....	*Lal tita pat* No. 27.	.....
Balasore and Cuttack	.....	Dhaula pita nalita No. 28.	.....
	.....	*Nala pita nalita* No. 29.	.....
			[Barapat No. 30.]

The table brings out graphically certain points. It emphasises the general lateness of the southern crops and the earliness of the northern crops. It emphasises the greater attention to selection that the ryot has exercised in the districts along the big rivers whereby he has there produced more races than elsewhere: and it emphasises the peculiar local prejudices in the matter of colour of the jute plant. These points are particularly interesting.

NORTHERN CROPS EARLY.

LOCAL GREATER SELECTION.

It will perhaps be well to leave discussion of this red choice until **C. olitorius** has also been considered, and therefore we turn to the question of selection. We have shown how innocent of ideas regarding earliness and lateness the ryots of the newer jute districts are, so that they are content with a very mixed crop. Certainly in these mixed crops we get many intermediate plants which fruit along with the others and in the course of time would apparently make the mixture into one series. These intermediates the more skilled ryots of the Faridpur, Pabna and Dacca districts have tried to remove at least from their best crops. Thus it comes about that in those districts there is an ordinary race—the Desi or Desoál—and with it other better crops that on examination are seen to be less variable, *i.e.*, more carefully selected. This is well exemplified at Serájganj, where Kákyá Bombái has not the variability of Desoál, or at Madáripur, where Udhap has not the variability of Sutpát, or in western Mymensingh, where Parbatyá has not the variability of Aus.

CHOICE OF RED.

SELECTION.

The specially selected races lie near the ordinary or desi races each in their own districts. For instance, the selected races of Faridpur are late like the country races, and in Jagannáthganj we get the early selected Barápát by the side of the early country Aus.

SELECTION IN CORCHORUS CAPSULARIS.

The tendency for the ryots in the North to grow earlier races than those of the south is no accident: it is connected with the climate, the rise of the rivers, and the needs of the particular kind of rice or other crop that alternates with the jute.

The branching habit has certainly been selected out of the best varieties.

It is a question if any do better in water than on moist land, but some are said to have been selected the more effectually to withstand the injurious effects of flood-water than others.

With the table above and after reading these remarks the reader who has perhaps been rather bewildered by the number of races that we have kept apart—tentatively—may perhaps feel satisfied in grasping the idea that the species **C. capsularis** is one which cultivators of it for fibre have broken up into four divisions, early green-stemmed, early red-stemmed, late green-stemmed and late red-stemmed, and, having done so, have proceeded to develop out of these four main divisions a number of local modifications, chiefly improvements.

CORCHORUS CAPSULARIS.

This view is simple, and it only rests to add that those who have grown **C. capsularis** for the pot have made other distinct races out of it, which could not well serve for fibre.

The local modifications just spoken of are of the first importance to any one starting to improve further.

Corchorus olitorius, Linn.

CORCHORUS OLITORIUS.

About Calcutta where **C. olitorius** is eaten as a pot-herb and **C. capsularis** considered a medicine, the first is called Mitha pát or sweet jute and the second Tita pát or bitter jute. The name Mithá pát becomes in Orissa Madhur nalita, with the same meaning (madhur-sweet; and nalita which is from the Sanskrit nádiká, having become the equivalent of pát).

The typical late races of Howrah, Hughli and the 24-Pergannahs, our Nos. 1 and 2.

Near Calcutta, all round Hughli and Barrackpur, and up to Kalna on the west side of the river or to Ránághát on the east we have two jutes grown extensively in adjoining plots. The one is green-stemmed and the other is red-stemmed; and the cultivators are at some pains to keep them separate. They are respectively Desi pát and Desi Lál pát.

In very many parts of their area **C. capsularis** is wholly absent, and it is quite unnecessary to use the word Desi as a distinctive adjective: in those parts the first becomes Sáda pát (white jute) and the second Lál pát (red jute), as for instance the custom is on the west side of Howráh and about Baráset.

Desi pat.

Desi pát and Desi lál pát differ in colour of stem only, and not at all in the time of ripening.

Race No. 3.

At Hughli no other races are grown, but at Bongong, besides these two, there seems to be a still later race called Bodan, which on August 20, 1906, was not even in bud, whereas at Burdwan on August 10 Desi pát was in flower.

Bodan has green stems. We have not had an opportunity to study it properly.

The typical early races of Faridpur, Nadia and Murshedabad, our Nos. 4 and 5.

On the banks of the Ganges about Faridpur we have red and green-stemmed **C. olitorius**. Bagi or Bogi or Bomi is the name of both; if green-stemmed, it is Dháulesbogi or Bági, if red-stemmed it is Lál bogi or bagi or Nál bági. Bági or Bogi or Bomi, when used alone, generally mean the green-stemmed plants. It is said that the word Bági is derived from Bág or Bák a stock, but it is not clear why it should be applied.

At Rájbári, Pachuria, and other places in the west of the Faridpur district this plant is called Sutnalá (*i.e.*, thread reed).

Bági or Bomi spreads down through the Nadia district to meet the Hughli Desi pát near Ránághát, and spreads westwards in Murshedabád, where it predominates over other jutes.

CORCHORUS OLITORIUS.

We need now to compare the Desi pát of Hughli with the Bogi of Faridpur. The two were grown together at Bardwán and Pusa in 1902, 1903 and 1904, the latter under the name of Sutnalá of Rájbári. After 1904 the Sutnala of the Bardwán Farm was changed; either the seed of it and of a race called "Halbiláti" were interchanged, or more probably they were mixed by some mischance.

Bardwán Experimental Farm.

	Desi Lál pát of Hughli.	Sutnalá of Rájbári.
1902.		
August 28 . .	Hardly in bud yet . .	. *Early fruit nearly fully formed.*
1903.		
August 2 . .	No sign of flowers . .	. *In flower.*
1904.		
August 10 . .	No sign of flowers . .	. *In flower.*
September 22 . .	In flower with some fruits full size, but none ripe.	Still flowering; *some fruits ripe.*

We shall use the above races as standards for comparison and may now take the jute area, district by district, in the order which we adopted for **Corchorus capsularis.**

Faridpur. Race No. 4. Race No. 5. Race No. 2

About Faridpur most of the crops of **C. olitorius** are of Dháulesbogi or Dháulesbági; but Lál bogi or Rangabogi is not uncommon. Rarer than either of these is a late red race called to us by a cultivator Meghnál or Nálpát, which race apparently is the same as Deshi lál pát.

At Goálundo the same three races of **C. olitorius** occur, and at Pachuria the first two. The names Emtál and Bomi are in these places sometimes substituted for Bogi. Round Madáripur the two Bogi páts occur, Dháulesbogi being by much the commoner. They are grown on the higher banks of the rivers close to the crops of Sutpát (for which see page 47 above).

Bakarganj

These two races further extend into the district of Bákarganj.

Dacca.

In the Dacca district the word Bogi is displaced by Bangi or Bhangi.

The origin of the word bangi is very obscure. It denotes cotton in Behar, and has apparently done so for a very long time. We trace its use for jute back in India clearly for only sixty-five years, *i.e.*, to O'Shaughnessy's Bengal Dispensatory, where it appears as bhungee (page 229); but then the literature of jute is very meagre before that date. Hem Chunder Kerr (Report on Cultivation of, and Trade in, Jute, page 14) said that the word coming from bhanga=**Cannabis sativa**, was not in use amongst the Bengalis. Whether he was right

CORCHORUS OLITORIUS.

regarding the origin of the word or not, we cannot say, but in saying that bangi was not in use, he was certainly wrong and inconsistent; for he himself quotes it on page 15 as in current use in the district of the 24-Pergannahs.

Rumpf's remarks (Herbarium Amboynense) lend a little colour to Hem Chunder Kerr's suggestion that bangi is derived from the name of the Hemp-plant, for they show that in the latter part of the seventeenth century people did not think jute and hemp very different, for instance Rumpf says that the plant grew like the hemp plant, and the fibre was used in Arakan much, so that it was called "Cannabis aracanica" and, where introduced into the Island of Bœton, Gandja.

However, it is unprofitable to pursue the name 'bangi' further since no meaning can be ascribed to it in any way connected with the characters of the races to which it is applied.

Bangi of Narsingdi, Dacca, has been cultivated at Bardwán; and compared with Sutnalá it behaved as follows. There is little doubt upon the identity of the two.

Bardwán Experimental Farm.

	Bangi of Narsingdi.	Sutnalá of Faridpur.
1902.		
August 28	With full-sized fruits	Fruit nearly of full size.
1903.		
August 2	In flower.	In flower.
1904.		
August 10	In flower and with young fruits	In flower.
September 22	With some fruits ripe	Still flowering; with some fruits ripe.

Races Nos. 1 and 2.

The Bangi as grown at Narsingdi is usually green; but we find there also tall red crops of a race called Deonallyá (meaning Divine reed-jute), and more sparingly similar green crops. These 'mixed' had been cultivated at Bardwán and were found exactly to correspond with Desi pát and Desi Lál pát of Hughli. We have seen excellently grown crops of them near Narsingdi, the plants as much as 15 feet high on September 17th just before cutting.

Tippera.

Halbiláti of Tippera is known to us only from the Bardwán Farm Experiments. It is a tall late green-stemmed or red-stemmed jute not appreciably differing from the Deonallyá of Dacca. It is unnecessary to give a table of the way in which the two behaved as regards flowering time, etc., for they were exactly the same.

Pabna.

The common name in Serájganj for **C. olitorius** is Toshá or Tosa, be it green-stemmed or be it red-stemmed. Both green-

stemmed and red-stemmed are besides often called Barápatá. These Serájganj plants are late; comparing them with Desi Lál pát, we get the following table, which indicates no differences :— CORCHORUS OLITORIUS. Races Nos. 1 and 2 at Serajganj.

Bardwán Experimental Farm.

	Tosha of Serájganj.	Desi Lál pát.
1902.		
August 28	Buds just mature	Hardly in bud yet.
1903.		
August 2	No sign of flowers	No sign of flowers.
1904.		
August 10	No sign of flowers	No sign of flowers.
September 22	In flower; fruits not quite full size.	In flower, with some fruits full size, but none ripe.
1906.		
August 26	Just in flower	With flowers.
September 15	No flowers left; fruits not ripe yet.	No flowers left.

The same races extend to Jagannáthganj, Sarisibári, Kamárjáni and other places close to the river, but no **C. olitorius** is to be found towards Jamálpur. The word Tosha becomes Tolla at Jagannáthganj and is applied more strictly than Tosha at Serájganj to the green-stemmed plant, while the red becomes Pak Nallya or Nalita (*i.e.*, Pucca Nallya or Nalita, the genuine red jute). Mymensingh. Race No. 1. Race No. 2.

Nibta is a name sometimes used for Tollá, and as at Serájganj the name Barápatá also: but there is also another Barápatá at Jagannáthganj (see page 67).

The crops of Pak Nallyá are not many, but very conspicuous in the neighbourhood of the first two of the places named above. The Jagannáthganj ryots keep the red and green-stemmed plants more apart than do the Serájganj ryots.

Pak Nallyá was grown at Bardwán and is still being grown.

C. olitorius is apparently very rare in the district of Bogra: we found none of it at Fulchári or Bográ when we were examining crops at those places, and have been unable to examine closely the crops which we saw elsewhere. But it has been reported to us by Babu Annadhanda Sen, Manager of the Jaipur Government Estates, that two races are known called respectively Dháula Kochan and Lal Kochan, and the specimens kindly sent to us are of the late green and late red races apparently identical with Toshá. In Rangpur again **C. olitorius** is very rare and so also in Goálpárá. We have not seen it in either district. In Jalpaiguri it is hardly grown as a field crop, but it is grown somewhat freely in gardens for eating, and is called Máruá, a name already met with as applied to **C. capsularis** (see page 104). Bogra. Rangpur. Goalpara. Jalpaiguri.

CORCHORUS OLITORIUS.

Darjeeling. Dinajpur.

The cultivation of this Máruá occurs also in the Darjeeling Terái and in the northern part of the Dinájpur district. We have seen at Dinajpur crops of **C. olitorius** grown partly for fibre and partly for eating, under the name of Amoná. They were very red-stemmed and late; apparently this Amoná is Toshá of Serájganj again. If red, in the Nawábganj subdivision of the district, it is called Lál Madái,

Races 1 and 2.

and if green-stemmed Dhálá Madái: in the Gangarámpur subdivision it is called Bamukchi or Bomukti; and further it is reported to us also to be called Rábná in one part of Dinájpur.

Apparently Dinájpur only contains late red-stemmed and green-stemmed races, being our races Nos. 1 and 2.

Purneah.

At Forbesganj we found **C. olitorius** in gardens, grown for a vegetable; but never in fields. It was red-stemmed and called Lál pát or Meghnál. As a vegetable also the species is grown in gardens at Kissenganj under the name of Muniasi, at Araria as Gorson, at Purneah as Ghonka, but in a dwarf race, being only two feet high:

Bhagalpur.

also in gardens of the district of Bhagalpur is the same dwarf race grown for eating as Ghonka.

Malda.

In the district of Máldá, **C. olitorius** is not a crop, but stray plants are found in the crops of **C. capsularis,** branched and early,

Races 4 and 5.

and certainly equivalent to the Bogi páts of Faridpur. Cultivators there call them Hemtál. They may be either red-stemmed or green-stemmed. And again in the very north a race called Muniashi, which we have not seen, is a little grown: it may be the dwarf comestible race.

Rajshahi.

At Rájsháhi and Nattor, as well as between these places, a very considerable proportion of the jute crops is of **C. olitorius,** tall and late, called by the cultivators Barápát or Mitha Sánchi (sweet Sanchi or jute). It is both green-stemmed and red-stemmed and does not differ from races Nos. 1 and 2. When green-stemmed it is sometimes called Dudhrás. But again at Rájsháhi we have crops of early green-stemmed and red-stemmed **C. olitorius,** which are our races Nos. 4 and 5; the early red-stemmed is less abundant than the early green-stemmed. The Rájsháhi cultivators know very little about these races which they grow: many of them hardly understand that there are early and late races.

Sontal Pergannahs.

A few red and green-stemmed early plants of races Nos. 4 and 5 occur among the crops of **C. capsularis** at Rájmehál—accidental introductions only, just as they are in the district of Máldá.

Murshedabad.

In the district of Murshedabád **C. olitorius** is known at Lálgola in the north and called Emtál, but we found no crops of it there. At Berhampur and southwards, this species is plentifully grown, partly in the early races and partly in the late. At Berhampur the crops

Races Nos. 4 and 5.

are of green-stemmed and red-stemmed early, intermixed, and with occasionally late green-stemmed plants in them also. The Bengali

cultivators speak of the plants as Nál pát or Meghlál pát and Dháulá pát, or the late green-stemmed at Dudhsbár pát. In the very south of the Murshedabád district red-stemmed late crops occur plentifully, which are identical with the Desi Lál pát of Hughli, and may be called Kuchmardan pát.

CORCHORUS OLITORIUS.

Race No. 1.

The district of Nadiá produces all the four races—early green-stemmed and late green-stemmed, early red-stemmed and late red-stemmed: towards the south the crops are mostly late; whereas towards the north they are mostly early. South of Ránághát crops of the Desi pát and Desi Lál pát of Hughli are everywhere. North of Ránághát we get the Bogi páts of Faridpur, generally mixed as about Bágulá and Chuádángá, but more separate at Poradáha and places in the north. These early races are spoken of as Desi at Bágulá and Chuádángá.

Nadia.

Races Nos. 1, 2, 4 and 5.

At Bágulá the late green or Desi pát of Hughli, is mixed a little with the early, and is called Amona pát. At Chuádángá it is again present. At Pálási early races, mixed, are more common than late races, but both are present. The late races are called Bombái, and the early races Desi: red races are sometimes called Meghnál. At Poradáha there is a marked prejudice in favour of green crops, which results in the early crops being predominately green and the late crops generally wholly green. The late green is called Amona.

In the district of Jessore are grown the Desi pát and Desi Lál pát of Hughli: and besides there seems to be at Bongong the still later race—our No. 3 above on page 110. This race needs further investigation before its existence can be definitely established. At Bongong the Desi Lál pát is generally called Kártiksál (ripe in Kártik or October), and the green-stemmed Dháulá pát or Gangájoli (white like Ganges water).

Jessore.

Race No. 2.
Race No. 1.

In the 24-Pergannahs there are only the two late races and so also in the districts of Howrah and Hughli. They are commonly called Desi pát, or near Calcutta, whither men from all parts of Bengal bring the words of their own districts, the names of Emtál and Bogi or Bomi are not strange. The name Himat pát is also used; and not infrequently to distinguish C. olitorius from C. capsularis, the adjective Mitha (sweet) is inserted, so that we get the expressions Desi Mithá pát and Lál Desi Mitha pát. Towards the Jessore boundary we get in use the names Kártiksál and Dháuli boran, the latter being applied in the same way as the name Dháulá pát mentioned above.

24-Pergannahs.
Howrah.
Hughli.

Roxburgh (Flora Indica, ed. C. B. Clarke, 1874, page 429) speaks of jute as much cultivated in Bengal at the beginning of the last century under the name of pat and adds that a reddish variety was called Bun pat (modern spelling ban pát). The name should mean "wild jute": but in the name Bangi was certainly the origin.

CORCHORUS OLITORIUS.

Hem Chunder Kerr, in his Report, page 15, and Appendix li has a long list of names used in the 24-Pergannahs, Bangi pát and Bangi Lál pát among them, as well as Bogi and Lakhipur bagi pat. He has also a Lakhipur dholi pat and a Lakhi phul pat. In respect to the names Lakhipur bagi and the Lakhipur dholi it does look as if a contrast was intended between the red (bagi) and the green (dholi) which would run on all fours with Roxburgh's use of ban (for bangi) as indicating a red-stemmed race. It is probable that the names in Hem Chunder Kerr's report are to be assigned thus :—to Desi pat, his Desi pat, Sada dhakai pat, Lakhipur dholi pat, Aman dholi pat and Lakhi phul pat, and to Desi lal pat, his Bangi lal pat, Rangri pat and Lakhipur bagi pat. The unqualified names of Bangi pat and Bogi pat may be the one or the other. What his Ghritá kán-chán pát was, we do not know. However, this we believe, that, though the names are many, the races are but the few that we have described.

Midnapur.

In Midnapur **C. olitorius** is fairly abundant near the borders of the districts of Howrah and Hughli. Lanka Gurya, Laskar kani and Dulal are said to be its names used in the Tamluk sub-division. We have not sucessfully identified these three names with plants ; but Lanka gurya is the same name as Lanka gori, and Lanka gori about Calcutta is not **C. olitorius** but **C. capsularis**.

Race No. 1.

Race No. 2.

In the Contai subdivision **C. olitorius** is called Baitri pát and Balti pát. It is green-stemmed and late, being the same as the Hughli desi pat. Red-stemmed **C. olitorius** is also a little grown.

Balasore, Cuttack.

To Orissa extends sparingly the cultivation of green-stemmed late **C. olitorius**, which is there known as Madhur Nalita (*i.e.*, sweet reed-jute) or Nakreá Nalitá (*i.e.*, stick reed-jute) or Tarikani Nalita or Kusta Dhanialia (meaning of the last two uncertain). We found but a few crops of it in 1906 between Cuttack and Shishua and near the Baitaráni river towards Jájpur. They differed, varying from a reddish green to pure green.

Wild Plants and Races not grown for Fibre.

DISTRIBUTION OF C. OLITORIUS WILD OR GROWN FOR EATING IN INDIA.

Punjab plain.

The following are the places outside the jute cultivation area where the long podded jute is known to us to grow. It is recorded from Gujrat in the Punjab (Gazetteer of the Gujerat District, 1893, page 14) under the name of Bahárphali—a dwarf plant, eighteen inches high. It is common at Lyallpur in the Mianwali district, attaining on the best land as much as four feet in height. It has been sent to us recently from Dera Ghazi Khan on the Indus, where with **C. trilocularis** it is confused under the name of Sári Biplee. In 1888 Mr. J. F. Duthie distributed both species from that place under his number 7121 ; so that there has been no very recent

DISTRIBUTION OF CORCHORUS OLITORIUS.

introduction of it. We have no precise information regarding the kind of ground that it lives in nor its abundance.

North-Western Himalayas.

It grows at Kangra — a race with small leaves, of which we have not seen enough to report on.

Sir George Watt collected **Corchorus olitorius** at Suni on the Sutlej, north of Simla, altitude 2,000 feet, and a correspondent of his, Mr. E. R. Johnson, collected it below Simla at 4,000 feet. Both specimens are small, those from Suni being 2—3½ feet high, and those from 4,000 feet being only 1—1½ feet and in seed. Sir Henry Collett (Flora Simlensis, 1904, page 65) says that the plant occurs up to 4,000 feet, most frequently as an escape from cultivation, the leaves being eaten as a vegetable. T. Thomson collected it at Rámpur, which is still higher up the Sutlej than Suni. Sir George King collected it in Garhwál. Atkinson in the Gazetteer "Himalayan Districts, 1882, page 733, says that it is found in the Dehra Dun and is called Banphal,—a name thought by Dymock to be a corrupted form of Bhauphali, the well-known name of **Corchorus Antichorus**.

Nepal.

One of us has observed it twice wild at the upper limits of the sal forests of the Nepal terai—once under Niákot in the Trisuli Valley, and once between Bhimpede and Nimbuá-tár on the direct road from Raksál to Khátmandu. The plants were but two feet high.

United Provinces.

We have received specimens from Saharanpur of undoubtedly wild origin and of small size, attaining a height of two feet only. Kanji Lal in his Forest Flora of the (Dehra Dun) School Circle, North-Western Provinces (Calcutta, 1901, page 45) says that the plant is to be found wild at Dehra Dun and in large quantity in the Pathri Forest, Saharanpur Division. The wood is there used for making country matches. Edgeworth (in Journ. Asiatic Soc., Bengal, xxi., 1852, page 27) records obtaining it in the Banda district. Munro (Hortus Agrensis, 1844, page 9) said that it was sometimes cultivated near Agra: presumedly for eating.

Sind and Gujarat.

Murray (Plants and Drugs of Sind, 1881, page 64) records that it is found wild in Sind, and adds that it is called Bun pát (literally wild jute)—but see the probable origin of Ban phal above. Woodrow has collected it in Sind, locality not recorded. He has collected it also in Gujarat, locality again not recorded.

Southern Rajputana.

A very distinct race of **C. olitorius** is cultivated as a pot-herb in Alirajpur and Narsinghar under the name of Rajan or Badarizan. The first of these names is applied also to **Corchorus trilocularis**, which is there eaten by the Bhils as a vegetable. This form of **C. olitorius** that is eaten is only a couple of feet high.

Bombay.

At Bassein, north of Bombay, **C. olitorius** occurs plentifully on the bunds of rice-fields. No use is made of it. Natives sometimes call it Kangi, evidently in confusion for **Sida cordifolia**. Cooke (Flora of the Bombay Presidency, i., 149) quotes collections

DISTRIBUTION OF CORCHORUS OLITORIUS.

for it near Bombay of more than half a century ago. Our Bassein specimens are rather small.

Deccan hills.

We have seen it at Poona growing very branched as a weed in gardens. Cooke refers to it as a weed, and has himself collected it at Poona. Ritchie (teste Cooke) collected it at Belgaum and on the Rámghat, west of Belgaum. Talbot, Bombay Gazetteer, xv., page 428, records it as occurring at Teilapur. Perrottet collected it in the Shevaroy hills. Rice mentions it (Mysore and Coorg, i., 1877, page 55) as a vegetable of Mysore, put into curries and called Kotra goraji.

Ceylon.

Thwaites in his Enumeratio Florae Zeylanicae says that in the island of Ceylon it was "very common." This statement seems incorrect; for Trimen (Flora of Ceylon, i., page 182) says that he had never met with it. However, there is evidence that it has in Ceylon, for Moon collected it at Kalutara and Gardner at Bintenne.

Coromandel.

In the Godaveri delta we have seen it at Samalkot and Rajamundry, common there on lands not irrigated. At Rajamundry it was growing mixed with cotton and arhar above all irrigation. At Samalkot it was growing on the sides of raised footpaths. We have seen specimens from the Godavari district collected at Davypatnam by Gamble and from Adyar near Madras, both of which are small leaved and may well be the same pot-herb. Elliott (Flora Andhrica, 1859, pages 145 and 151) records it as growing in Ganjam, and names it Parinta. Mohideen Sheriff in his Materia Medica of Madras names the leaves as Punnak-kirai or Peratti kirai.

Chutia Nagpur and Gaya.

Northern Bengal

It occurs on the Chutia Nagpur plateau as shown by specimens collected at Gurhina in Lohadaga by Mr. C. B. Clarke—growing six feet high.* Haines has collected it in Singbhum. Buchanan Hamilton collected it in 1811 at Dariyapur in the district of Gaya.

Assam.

Hem Chunder Kerr (Report on Cultivation of and Trade in Jute, 1874, page 39) speaks of considerable cultivation of this species of jute for eating in the Katwa subdivision of Bardwán. Masters in 1848 recorded that it could be found in the Angami-Naga hills (see Journ. Agric. Hort. Soc., India, vi., 41).

Burma.

In Burma, **Corchorus olitorius** has been found by us at Padaung on the lower Irrawaddy, south of Prome; at Monywa on the Chindwin, and at Momouk, east of Bhamo, just at the foot of the hills whereon the Chinese boundary runs. The plant grew about 4—5 feet high, and was much branched. From the Records of the Government of India, is reprinted in the Journal of the Agricultural and Horticultural Society of India, ix., 1857, page 17, a statement that it is wild near Rangoon. We have seen specimens collected

* The Bir-narchá mentioned as a pot-herb of Chutia Nagpur in the Dictionary of Economic Products, para. C, 1871, is *C. acutangulus*, Lamk.

CORCHORUS OLITORIUS. REVIEW.

by Aubert and Gage in Minbu and by one of the Calcutta Botanic Garden Collectors. At the mouth of the Mu river near Myinmu, district of Sagaing, we also found it as a curiously developed plant spreading out along the ground. One of the specimens from Dera Ghazi Khan has branches spreading from the root; and it is not improbable that the similar habit of the plants in both these dry spots is a result of the dry climate.

Shan plateau.

It is found on the Shan plateau and in the neighbouring parts of China. And it is found in Java and other Malay Islands. Rumpf records that two centuries ago it had been brought to Amboyna from China, and it was then in Arakan and Bengal. To make it a profitable crop has once or twice been attempted in Java, but failed, leaving apparently the plant established wild in the marshes of Parang in the province of Buitenzorg. It is called Djepon in Java. Tijsmann and Binnendijk (*Catalogus plantarum quae in Horto botanico Bogorensi coluntur, Batavia, 1866, p. 199*) speak of a dwarf variety as known to them in Java. Miquel records that it was in the Sunda Islands and Timor about 1850. It is said to occur in the Philippine Islands.

Malaya.

China.

Regarding China we have Rumpf's statement that the plant was introduced into Amboyna from China, and Loureiro's old statement (Flora Cochin-Chinensis, I, 1790, page 408) that it was cultivated in the province of Canton, the record of its occurrence in several places in Formosa (*vide* Indian Planting and Gardening, 1904, p. 212, and Matsumura and Hayata in Journ. Coll. Science, Tokyo, xxii., p. 64), and the statement of Franchet (Bull. Soc. Bot. de France, xxxiii., 1886, page 441) that the Abbé Delavay sent it from Ta-pin-tze in the province of Yunnan.

Levant and Soudan.

These remarks complete the eastward distribution of **Corchorus olitorius.** Westward of India we find it established as an important pot-herb of the Levant, under the name of Melokyeh in Cairo and Syria, or of Mouchlia in Crete.

Kotschy collected the plant in Kordofan. His specimens carry very long beaks to the fruit, which probably are marks of a distinct variety.

The plant, as we have seen it offered in the Cairo bazaars, is but two feet high at flowering. The interesting speculation that it is the Maluch which is mentioned in the Biblical book of Job need not be gone into here.

Corchorus olitorius does not offer the same difficulties to one studying it as **Corchorus capsularis** does. For in the first place we do not find that local improvements upon the four divisions of early green, early red, late green and late red have been made by the cultivators. So much so is this the case that we admit but five races besides a dwarf pot-herb, and the fifth of them—the very late race from Bongong—is of somewhat doubtful existence. In the second place **Corchorus olitorius** as a fibre plant has a much narrower distribution than **Corchorus capsularis**, a distribution

CORCHORUS OLITORIUS.

Distribution of races in Bengal.

coinciding more or less with that of the late races of **C. capsularis.** Itself in its late races later than the latest races of **Corchorus capsularis,** it is still more markedly southern in Bengal proper than they. With its two early races it occupies a peculiar area—chiefly in the districts of Faridpur and Nadiá, in which they are found on the banks of the rivers, about the villages, where the flood but little comes. These early races are mature and ready for cutting just before the full flood-time arrives. The early and very high floods of 1906 caught them and killed them ; but as a rule this does not happen. No doubt cultivation of these early races has been adopted in those places because they are so opportune in their ripening; and further the cultivator who makes his own cattle halters, and the like things, is indifferent to colour for that purpose and does not seek the more silvery less stout fibre of the many races of **Corchorus capsularis** which he might cultivate to ripen at the same time. However, this is but a partial and not a complete explanation of the local abundance of early **C. olitorius** in Faridpur and Nadia, and its great rarity a little way north of the river Ganges in the districts of Pabna, Dacca, Mymensingh, etc.

Not very much trouble is taken with the early races: they are generally mixed together, red-stemmed with green-stemmed; and the plant very markedly branches at a height of about five feet. But with the late races much trouble is taken, and a visit to Hughli or almost any other centre of their cultivation impresses one at once with the way in which the red and the green are separated. Also in Nadia and Faridpur into which the late races sparingly penetrate, the crops of them when found are generally pure,—green-stemmed by itself, and red-stemmed by itself. However, at Serájganj and in the Dacca district this is by no means always so.

Commonly used names.

We give a table to indicate the names by which the four well-defined races most commonly pass in the various districts.

	Early green.	Early red.	Late green.	Late red.
Faridpur	Dháulesbogi	Lálbogi	.....	? Meghnál.
Bákarganj	Dháulesbogi	Lálbogi	.....	.....
Dacca	Dháula bangi	Lál bangi	Dháulá Deonallyá.	Lál Deonallyá.
Tipperá	.....	.....	Halbilati	.....
Noákháli	.....	.....	.....	.....
Pabná	.....	.....	Toshá	Toshá.
Mymensingh	.....	.....	Tollá	Paknallyá.
Dinájpur	.....	.....	Dháulá Madai	Máruá or Lál Madái.
Purneáh	.....	.....	.....	.....
Máldá	Hemtál	Hemtál	.....	.....
Rájsháhi	?	?	Dudhrás	?
Murshedabád	Emtál	Emtál	Dháulápát	Lálpát.
Nadiá	Desipát	Desipát	? Sutnalá	?
Jessore	...	...	Gangájoli	Kártiksál.
24-Pergannahs	...	...	Desipát	Desi Lál pát.
Howrah	...	...	Desipát	Desi Lál pát.
Hughli	...	...	Desipát	Desi Lál pát.
Cuttack	...	...	Madhur Nalitá	.....

A List of the Vernacular Names applied to Jute in the East.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Ágniswár, meaning very fiery, applied to Race No. 10 of **Corchorus capsularis** in Dacca.

Áhee pata, said by Hem Chunder Kerr to be used in Kamrup.

Ámana pat or Amoni pat, meaning late in season, applied in Dinájpur to Race No. 2 of **Corchorus olitorius,** and applied to Race No. 1 of **Corchorus olitorius,** in Nadia.

Ámón pát, meaning jute late in season, applied to Race No. 2 in Faridpur, and Nadia; also used in Sylhet.

Ámónia=Ámón, applied to **Corchorus capsularis** and in Nadia especially to Race No. 2.

Amos, said by Hem Chunder Kerr to be applied to **Corchorus capsularis** in Mymensingh, but almost certainly a misprint for Amon.

Aus, meaning early in season, applied to Race No. 1 of **Corchorus capsularis** in Faridpur, and to Race No. 17 in Mymensingh and Bogra.

Ausá pát, form of Aus pát used in Mymensingh and Sylhet.

Badarizán, a name applied to **Corchorus olitorius** in Southern Rajputana.

Bági, perhaps derived from bag, a stork, a name for Races Nos. 4 and 5 of **Corchorus olitorius** in Faridpur and Bákárganj; if unqualified it indicates Race No. 4. The name is also not unknown in the 24-Pergannahs.

Báhuphali, meaning little plant with many fruits, a name for more than one species of **Corchorus** in the Panjab, amongst them **Corchorus olitorius.**

Baitri pat, meaning unexplained, applied to Race No. 1 of **Corchorus olitorius** in Midnapur.

Bálti pát, probably a corruption of beláti pát, meaning foreign jute, applied to Race No. 1 of **Corchorus olitorius** in Midnapur.

Bamukchi, applied in the Dinájpur district to Race No. 2 of **Corchorus olitorius.**

Bangi, a word of very uncertain origin, used in the districts of Dacca and Tippera to denote **Corchorus olitorius.** There are three possible origins for it: (1) that it denotes the jute of Bhanga in Faridpur, (2) that it is the same word as Bangi applied to Cotton in Behar, and (3) that it comes from Bhang meaning hemp. The word is still in use in the Dacca district for Races Nos. 1 and 2 of **Corchorus olitorius** and was formerly in use in the 24-Pergannahs for **Corchorus olitorius.**

Bangi Lál pát, said by Hem Chunder Kerr to be used in the 24-Pergannahs.

Ban-pát, meaning wild jute, a name recorded as used in Sind and Bengal for **Corchorus olitorius**, in the second instance perhaps for Bangi pát.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Bauphal, applied to **Corchorus olitorius** in Garhwal, probably a corruption of Bahuphali or Bhauphali.

Bará Koshtá, quoted by Hem Chunder Kerr as a name for **Corchorus olitorius** in Pabna.

Barápát, meaning big jute, applied to Race No. 14 of **Corchorus capsularis** in Pabna and western Mymensingh, and also applied to Race No. 15 of **Corchorus capsularis**; again applied to Race No. 30 of **Corchorus capsularis** in Cuttack, and further to Races Nos. 1 and 2 of **Corchorus olitorius** in Pabna and Rajshahi.

Barápatá=Barápát.

Barán, meaning big, applied to Race No. 20 of **Corchorus capsularis** in western Mymensingh.

Belgáchi pát, meaning jute plant of Belgachi, applied to Race No. 5 of **Corchorus capsularis** in Faridpur and Dacca.

Bengál Márá, said by Hem Chunder Kerr to be used in Nowgong.

Beral, a name said by Hem Chunder Kerr to be used in Midnapur.

Bhangi, see Bangi.

Bhilan or Bilan, meaning 'of the marshes', applied in Faridpur to certain races of **Corchorus capsularis** grown in the bhils or marshes.

Bhut-kori, meaning ghost's cowries, applied in Murshedabad, Birbhum and Nadia to **Corchorus capsularis**.

Bhuri pát, communicated to us as a name of Faridpur, but probably meant for Barápát and indicative of Race No. 2 of **Corchorus capsularis**.

Bidyá Sundar, the words mean 'fine knowledge', but possibly bidya here has some other and obscure interpretation, applied to Race No. 10 of **Corchorus capsularis** in Dacca, Tippera and Sylhet.

Bilan, see Bhilan.

Bite pát, the name given by Hem Chunder Kerr for Baitri pat.

Bitri, meaning early, an adjective used in Rangpur to indicate early races of **Corchorus capsularis**.

Bodan, applied to Race No. 3 of **Corchorus olitorius** in Jessore.

Bogi=Bagi.

Bomi, applied to **Corchorus olitorius** in the 24-Pergannahs, and apparently derived from Bogi.

Bomukti=Bamukchi.

Botocari, Hem Chunder Kerr's rendering of Bhut-kori, as used in Birbhum.

Bugi, used by Hem Chunder Kerr for Bogi.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Bugnal, a name quoted by Hem Chunder Kerr, probably incorrectly, as in use in the 24-Pergannahs for a race of **Corchorus capsularis**. The name suggests Bogi-nál, which would mean red Bogi.

Bun Muchki, spelling of Bomukti given by Hem Chunder Kerr as used in Dinájpur.

Bun pat, see Ban pát.

Bun phal, see Banphal.

Chaka Mára, an Assamese name for **Corchorus capsularis**.

Chánd pát, meaning silver jute, a name said by Hem Chunder Kerr to be used in Howrah.

Chat mára, said by Hem Chunder Kerr to be used in Lakhimpur.

Chattua, applied to **Corchorus capsularis** in Khulna.

Chhorán, meaning little, applied to Race No. 18 of **Corchorus capsularis** in western Mymensingh.

Chhotá Koshtá, used by Hem Chunder Kerr as a name for **Corchorus capsularis** in Pabna.

Chhotá pát, meaning little jute, applied to Race No. 18 of **Corchorus capsularis** in Mymensingh.

Chirá or Chirá-mirá, the edible **Corchorus capsularis** of Purneáh, Jalpáiguri and the Darjeeling-Terái. Mira is evidently the same word as Marua which see.

Chiral Naricha, a name quoted by Hem Chunder Kerr as applied in Dinájpur to an edible **Corchorus capsularis** doubtless Chira.

Chirua=Chira, pronunciation not uncommon in Jalpáiguri.

Choro pát, used by Hem Chunder Kerr as a name for **Corchorus capsularis** in Pabna.

Cowplá or kaupla applied to Race No. 3 of **Corchorus capsularis** in Faridpur and Bákarganj.

Deebri pat, said by Hem Chunder Kerr to be a name for a jute in Jessore.

Dehea pata, said by Hem Chunder Kerr to be used in Darrang.

Deodháli, meaning divinely white, applied to Race No. 11 of **Corchorus capsularis** in Tippera.

Desál, meaning 'country' and equivalent to Desoál and Desi, applied to Race No. 17 of **Corchorus capsularis** in western Mymensingh.

Deshi Aus or Desi Aus, see Aus.

Desi pát, meaning 'country', applied generally to the commonest race in the district, to Race No. 3 of **Corchorus capsularis** in south Faridpur, to Race No. 8 in Dacca, to Races Nos. 4 and 5 of **Corchorus olitorius** in Nadiá, and to Races Nos. 1 and 2 of **Corchorus olitorius**, particularly No. 1, in Howrah, Hughli and the 24-Pergannahs.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Desi Meghnál, applied to Race No. 21 of **Corchorus capsularis** in Bogra.

Desi Nallya, meaning country reed-jute, applied to Race No. 8 of **Corchorus capsularis** in Dacca.

Desi Lal pat, meaning country red jute, indicates in Howrah, Hughli and the 24-Pergannahs Race No. 2 of **Corchorus olitorius**.

Desál peti pat, meaning little country jute, applied to Race No. 3 of **Corchorus capsularis** in Faridpur.

Desoál or Deswál, meaning country, applied to Race No. 13 of **Corchorus capsularis** in Pabna.

Deo-nallyá, meaning divine reed-jute, applied to Races Nos. 1 and 2 of **Corchorus olitorius** in Dacca.

Dhálesbági or Dhálesbogi, meaning white bagi, applied to Race No. 4 of **Corchorus olitorius** in Faridpur and Bákarganj.

Dháleswári, meaning exceedingly white, applied to Race No. 1 in Faridpur, and apparently also in Nadiá, applied to Race No. 7 in Dacca, Tipperá and Sylhet.

Dháli, meaning white, an abbreviation of the name Deodhali.

Dhál Sundar, meaning beautifully white, applied to No. 7 of **Corchorus capsularis** in Dacca and Tipperá.

Dhamai, given by Hem Chunder Kerr as used in Máldá for **Corchorus capsularis** doubtless equivalent to Dhamar.

Dhámar, applied to a race, apparently No. 21 of **Corchorus capsularis**, in Purneáh.

Dhapa, probably meaning bright, a name reported from Faridpur for a race of **Corchorus capsularis**.

Dháulá Amon, meaning white late, applied to Race No. 24 of **Corchorus capsularis** in Mymensingh.

Dháulá Aus, applied to Race No. 26 of **Corchorus capsularis** in Goálpárá, to Race No. 17 in Mymensingh, and to Race No. 22 in Rangpur.

Dháulá Bhádiya or Dhála Bhadoya, meaning white early or literally of the month of Bhadar, applied to Race No. 22 of **Corchorus capsularis** in Purneáh, Dinájpur, Jálpáiguri and the Darjeeling-Terái.

Dháulá Bitri, applied to Race No. 26 of **Corchorus capsularis** in Goálpárá, and to Race No. 22 in Rangpur.

Dháulá Haimantiá, meaning white late, literally of winter, applied to Race No. 24 of **Corchorus capsularis** in Goálpárá, Dinájpur and the Darjeeling-Terái.

Dháulá Hewti, meaning white late, applied to Race No. 24 of **Corchorus capsularis** in Purneáh and Jalpáiguri.

Dháulá Kochan, meaning white Kochan, applied in Bogra to Race No. 1 of **Corchorus olitorius**.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Dháulá Madái, applied in Dinájpur to Race No. 1 of **Corchorus olitorius**.

Dháulá pát, meaning white jute, applied to Race No. 17 of **Corchorus capsularis** in Bográ.

Dháulá Sánchia, meaning white sánchia, applied in Rájsháhi to the green-stemmed races of **Corchorus capsularis.**

Dhobsur, said by Hem Chunder Kerr to be applied to **Corchorus capsularis** in Mymensingh.

Dholi boran, applied to Race No. 1 of **Corchorus olitorius** in the 24-Pergannahs.

Dháulápát, meaning white jute, applied in Murshedabád to Race No. 13 of **Corchorus capsularis** and also to Races Nos. 1 and 4 of **C. olitorius.**

Dhules sepori, a name given by Hem Chunder Kerr as used in Tipperá; it is probably a mistake for Dháleswári.

Dhupri, meaning bright, a name reported from Faridpur for a race of **Corchorus capsularis.**

Djepon, the Javanese name for **Corchorus olitorius.**

Dudhsár, meaning like cream, applied in Máldá to a race perhaps identical with No. 13 or No. 1 of **Corchorus capsularis.**

Dudhshar=Dudhsar.

Dudhrás, applied to Race No. 1 of **Corchorus olitorius** in Rájsháhi.

Dulál, said to be applied to a race of **Corchorus olitorius** in Midnapur.

Emtál, applied to **Corchorus olitorius** in Murshedabád and the 24-Pergannahs.

Fulleshwári, see Phuleswári.

Gangajoli, meaning white like Ganges water, applied to Race No. 1 of **Corchorus olitorius** in Jessore.

Ghagri, possibly meaning round like a top referring to the fruits, applied to Race No. 2 of **Corchorus capsularis** and perhaps more generally to other races.

Ghi-nalita, a name found in old books which would mean "butter jute." In support of the genuineness of its use, there is the name, similar in meaning, of Ghrita Kanchan pát. Yet seeing that Bangi pát has apparently given rise in Bengal to Ban pat, why should not Bangi nalita have given rise to Ghi-nalita by the dropping of the misunderstood first syllable.

Ghrita Kanchan pát, the first two words meaning in Sanskrit golden butter, said by Hem Chunder Kerr to be applied to **Corchorus olitorius** (probably Race No. 2) in the 24-Pergannahs.

Ghonka, applied in Purneáh and Bhagalpur to the race Muniasi of **Corchorus olitorius** which is eaten (see p. 120).

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Gopal Choq, given by Hem Chunder Kerr as a name of **Corchorus capsularis** in Dinájpur.

Gorson, applied in Purneáh to the race Muniási of **Corchorus olitorius** which is eaten (see p. 114).

Halbiláti, applied to Races Nos. 1 and 2 of **Corchorus olitorius** in Tipperá.

Harruá or Harrawá, used in the United Provinces (Rohilkand) for **Corchorus capsularis.**

Hanumán pát, meaning Hanuman's jute, a name for **Corchorus capsularis** used in Midnapur.

Hematgár, applied in the 24-Pergannahs to **Corchorus capsularis.**

Hemtia, given by Hem Chunder Kerr as the name of a race of **Corchorus capsularis** in Dinájpur—the equivalent evidently of Haimantiá.

Hemtara, a word given by Hem Chunder Kerr as the name of a race of **Corchorus capsularis** in Murshedabád.

Hewti, Heoti, Hetiá or Hetwá, meaning late, an adjective used in Jalpáiguri and Goálpárá to contrast with Bhadoya.

Himtál, the equivalent of Emtál, used in Máldá for **Corchorus olitorius.**

Himatpát, applied to **Corchorus capsularis** in the 24-Pergannahs, and said also to be applied to **C. olitorius.**

Játi, a word used in Bogra, Rangpur, Jalpáiguri, Goálpárá and the Brahmaputra Valley to indicate **Corchorus capsularis.**

Játi Bhadoga, given by Hem Chunder Kerr as the name of a race of jute in Dinájpur: Bhadoga may be a misprint for Bhadoya.

Jhot pat or Jhut pat, the name for **Corchorus capsularis** in the district of Midnapur, possibly the origin of, or possibly derived from, the word 'jute': if unqualified it means apparently Race No. 26 of **C. capsularis.**

Jhunt, said by Hem Chunder Kerr to be used in Cuttack.

Joli, used by Hem Chunder Kerr, and believed by us to be a mistake for Jati.

Kájla or Kájli, meaning dark, applied to Race No. 8 of **Corchorus capsularis** in Dacca and Tipperá.

Kákyá Bombái (origin unexplained), applied to Race No. 15 of **Corchorus capsularis** in Pabná and Bográ. Seeing that Kakya is pronounced Kashya in Bográ, it is possible that it and Koshtá have a common origin: while Bombái means of Bombay; but of course the race never came thence.

Kala Naricha, given by Hem Chunder Kerr as a name of **Corchorus capsularis** in Dinájpur.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Kamárjáni pát, meaning jute plant of Kamárjáni in Mymensingh, applied apparently to Race No. 5 in Faridpur, northern Jessore and apparently also in Pabná and northern Nadiá.

Kanji, the name of **Sida cordifolia**, misapplied to **Corchorus olitorius** in the Thána district, Bombay.

Kártik sál or Kártik shál, meaning belonging to the month of Kartik or November, applied to Race No. 2 of **Corchorus olitorius** in Jessore.

Kashom ran, the Santali name for **Corchorus capsularis**.

Káshyá Bombái, the common pronunciation in Bogra of Kákyá Bombái.

Kauplá, applied to Race No. 3 of **Corchorus capsularis** in Faridpur and Bákarganj.

Khetra, a name said by Hem Chunder Kerr to be used in Midnapur.

Kochan, see Dháulá Kochan and Lál Kochan.

Kohap, a name reported from Faridpur for a race of **Corchorus capsularis**.

Kostá or Koshtá, widely used in the districts of Nadiá, Jessore, Khulná, the 24-Pergannahs, Howrah and Midnapur, and known in almost every district as a name for **Corchorus capsularis**.

Kotna Goraji, said to be the Mysore name of **Corchorus olitorius**.

Kuchiamuri, said by Hem Chunder Kerr to be a name in use in Mymensingh. The word looks as if denoting the 'márá' or jute of the Kuches.

Kuchmadan, applied in Bogra and western Mymensingh to Race No. 20 of **Corchorus capsularis**, and in Murshedabád and Nadiá to Race No. 5 of **C. olitorius**.

Kuchmardan pat=Kuchmadan.

Kuchni, applied to Race No. 21 of **Corchorus capsularis** in Bogra.

Kusta Dhanialia, said to be applied to **Corchorus olitorius** in Orissa.

Lál Aus or Lál Ausá, meaning red early, applied to Race No. 23 of **Corchorus capsularis** in Goálpárá and Rangpur.

Lál Bági pát, meaning red bági jute, indicates Race No. 5 of **Corchorus olitorius** in Faridpur, Bákarganj.

Lál Bhádiyá, meaning red early, or of the month of Bhadar, applied to Race No. 23 of **Corchorus capsularis** in Purneáh, Dinájpur and Jalpáiguri.

Lál Bitri, meaning red early, applied to Race No. 23 of **Corchorus capsularis** in Goálpárá and Rangpur.

Lál Ban pát, meaning literally red wild jute, but see Ban pat above—a name said by Hem Chunder Kerr to be in use in Howrah.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Lál Dhámar, meaning red Dhámar, applied to a race apparently No. 23 of **Corchorus capsularis** in Purneáh.

Lál Haimantiá, meaning red late or of cold weather, applied to Race No. 25 of **Corchorus capsularis** in the Darjeeling-Terái and Goálpárá, and to a race of **Corchorus capsularis** in western Mymensingh.

Lál Hewtia or Lál Hetiá, meaning red late, applied to Race No. 25 of **Corchorus capsularis** in Jalpáiguri, Purneáh and Rangpur.

Lál Jhot pát, meaning red Jhot pát, a name in use for a race, probably No. 28 of **Corchorus capsularis** in Midnapur.

Lál Karái, a name said to be used in Mymensingh for a race of **Corchorus capsularis.**

Lál Kochan, meaning red, applied in Bográ to Race No. 2 of **Corchorus olitorius.**

Lál Koshtá, meaning red jute, a name in use for a race of **Corchorus capsularis,** probably No. 28 in Midnapur.

Lál Madái, meaning red madai, applied in Dinájpur to Race No. 2 of **Corchorus olitorius.**

Lál pát, meaning red jute, very loosely applied; applied in Murshedabád to Race No. 16 of **Corchorus capsularis,** to Race No. 6 in Faridpur, and to a race of **C. olitorius** that is eaten in Purneáh.

Lál Patwá, equivalent to Lál pát, applied to a race apparently equal to either No. 16 or No. 25 in Máldá.

Lál titá pát, meaning red bitter jute, a name used in the 24-Pergannahs for Race No. 27 of **Corchorus capsularis.**

Láli, meaning red, applied to Race No. 16 of **Corchorus capsularis** in Pabná.

Lanká Gori or Lanká Guriyá, meaning obscure, applied to **Corchorus capsularis,** in the districts of 24-Pergannahs, Howrah and Midnapur: also said to belong to a race of **Corchorus olitorius** in Midnapur.

Laskar Káni, said to be applied to a race of **Corchorus olitorius** in Midnapur.

Leha, given by Hem Chunder Kerr as in Dinájpur equivalent to Játi.

Lohkori mora or Loha Kori, said by Hem Chunder Kerr to be used in Darrang and Lakhimpur.

Lal Petre pat, a name occurring in Royle's Fibrous Plants, a mistake for Lál Bitri pát, and nothing to do with the Sanskrit for a leaf as Hem Chunder Kerr says.

Luckipore pat, said by Hem Chunder Kerr to be used in the 24-Pergannahs for a race **C. olitorius** (probably No. 1).

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

One fairly well-known Lakhipur is in the delta in Noákháli; another is in Goálpárá. But the name may be connected with neither of these.

Lucki Fool Bogi (Lákhi phul bogi), said by Hem Chunder Kerr to be used in the 24-Pergannahs for a race of **Corchorus olitorius.**

Madhur Nalitá, meaning sweet jute, a general name in Orissa for **Corchorus olitorius.**

Madhuri, a name given by Hem Chunder Kerr as used in Tirhut.

Márá or Morá, Assamese equivalent of Marua, see Bengal Mora, Chaka Mora, Chatmora, Lohkori Mora, Mitha mora, Pat mora, Tenga mora, Tita mora.

Marna, given by Hem Chunder Kerr as a name for **Corchorus olitorius** in Dinájpur—probably a misprint for marua.

Máruá, a name for **Corchorus olitorius** in Jalpáiguri, the Darjeeling-Terái and Dinájpur; whence Buchanan Hamilton took the specific name for his **Corchorus Marua.** If qualified by Chira (*e.g.*, Chira Mira) it indicates the edible **C. capsularis,** or Chaka Mora of Assam.

Meghlál, equivalent to Meghnál, applied to Race No. 23 of **Corchorus capsularis** in Dinájpur, and to Races Nos. 2 and 5 of **C. olitorius** in Murshedabád.

Meghnál, meaning red cloud, applied to Race No. 6 of **Corchorus capsularis** in Faridpur, to Race No. 23 in Dinájpur and Purneáh, to Race No. 21 in western Mymensingh; applied to any red-stemmed **C. capsularis** in Murshedabád, and misapplied to **C. olitorius** in Purneáh and sometimes in Faridpur (to Race No. 2).

Melokyeh, the name in the Levant for **Corchorus olitorius.**

Merwah pát, said by Hem Chunder Kerr to be used in the Darjeeling district; doubtless Máruá or Miruá.

Miruá, equivalent to Chirua for **Corchorus capsularis** in Jalpáiguri, etymologically equal to Máruá.

Mitha Mara, given by Hem Chunder Kerr as used in Nowgong.

Mithá pát, meaning sweet jute, a general name in Lower Bengal for **Corchorus olitorius.**

Mithá Sánchiá or Sanchi, denotes **Corchorus olitorius**, as distinguished from **C. capsularis,** in the districts of Máldá and Rájsháhi.

Mora, see Mara.

Mora pata, said by Hem Chunder Kerr to be used in Kamrup and Lakhimpur; it is a curious combination of Mara (Assamese) and Pata (Bengali).

Mora sak, said by Hem Chunder Kerr to be used in Sibsagar.

Mouchlia, the Cretan name for **Corchorus olitorius.**

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Muniáshi, the Bengali pronunciation of Muniasi, a race of **Corchorus olitorius** in Máldá, where it is grown for eating.

Muniási, a dwarf form of **Corchorus capsularis**, eaten as a pot-herb in Máldá and Purneá.

Nádiká, the Sanskrit origin of Nalita.

Nakrea Nalitá, meaning stick jute, applied in Orissa to Race No. 1 of **Corchorus olitorius.**

Náiltá, probably a form of Nalita, applied to Race No. 16 of **Corchorus capsularis** in Pabna.

Nál bitri, meaning red early, applied to Race No. 23 of **Corchorus capsularis** in Rangpur.

Nálpát, equivalent in meaning to Lálpát, applied to Races Nos. 2 and 5 of **Corchorus olitorius** in Murshedabád, to Race No. 21 of **C. capsularis** in Mymensingh, to Races Nos. 2 and 6 of **C. capsularis** in Faridpur, and to Race No. 15 in Bogra.

Nalá pitá Nalitá, meaning red bitter jute, applied in Balasore and Cuttack to Race No. 29 of **Corchorus capsularis.**

Nalitá pat, given by Hem Chunder Kerr as used in Máldá for **Corchorus capsularis**, and as Nalia said by him to be used in Mymensingh also.

Nalitá, commonly applied to the dried bitter leaves of **Corchorus capsularis** as preserved for a medicine in Lower Bengal, but also indicating the plant itself, chiefly to the south-west of Calcutta, where it is used as equivalent to 'pát.'

Nalta Patwa, an expression given by Hem Chunder Kerr by the side of Muniasi patwa, as in use in Máldá. The only Máldá races in his list are these two. Apparently the second is that race which is eaten and not bitter, and this, the other, is the medicinal and bitter Nalita. Etymologically this might be most important evidence that Patwa was a word in use for a fibre plant, long before the people of the district came to know the medicinal bitter Nalita; but the use of Nalta Patwa should be corroborated.

Naricha, used in Dinajpur in the place of Nalita, see Chiral Naricha and Kala Naricha.

Narish, a name quoted by Hem Chunder Kerr as used in the Chittagong Hill Tracts for a jute—doubtless **Corchorus capsularis** grown for eating.

Naskar-Kani, an equivalent given by Hem Chunder Kerr of Laskar Kani (*q. v.*).

Nibtá, applied perhaps to Race No. 25 of **Corchorus capsularis** in Pabna, and also applied to a race of **C. olitorius.**

Numliá pát, a name said by Hem Chunder Kerr to be used in Bogra for a race of **Corchorus capsularis.**

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Paháriah, meaning of the hills, said by Hem Chunder Kerr to be a name in use in Kuch Behar.

Pak-Nallyá, meaning genuine reed-jute, applied in western Mymensingh to Race No. 2 of **Corchorus olitorius.**

Pánchia, a name said to be used for Race No. 13 of **Corchorus capsularis** in Pabna, apparently the same word as Sánchia.

Parbatyá, meaning belonging to high ground, applied to Race No. 7 of **Corchorus capsularis** in Faridpur, Dacca and Sylhet and to Race No. 24 in western Mymensingh.

Parinta, the Telegu name for **Corchorus olitorius.**

Pát mora, said by Hem Chunder Kerr to be used in Lakhimpur.

Patlai, said by Hem Chunder Kerr to be applied to **Corchorus olitorius** in Mymensingh.

Patna, given by Hem Chunder Kerr as used in Bhagalpur and Purneáh, but really a misprint for Patua, *i.e*, patwa.

Patnai pat, said to be used in Bogra for **Corchorus capsularis.** Is this not patwa and pát put together?

Paturi, said to be applied to **Corchorus capsularis** in southern Nadiá, probably to Race No. 26.

Pát, meaning jute; the origin is uncertain and need not be discussed here. See Nalta patwa.

Patwá, equivalent to pát, and in general use in the districts of Purneáh and Máldá.

Pechi pát, applied to Race No. 3 of **Corchorus capsularis** in Bákarganj, and probably also in Tippera and Sylhet.

Peratti Kirai, the Tamil name for leaves of **Corchorus olitorius** which are eaten; Kirai means a green or vegetable.

Phuleswári, meaning apparently 'excellent like a flower,' applied to Race No. 12 of **Corchorus capsularis** in Tippera and Sylhet.

Pitá Nalitá, meaning bitter jute, applied to **Corchorus capsularis** in Balasore and Cuttack; if unqualified it means Race No. 28.

Purbi, a name given by Hem Chunder Kerr as used in Tirhut.

Punnek Kirai, the Tamil name for **Corchorus olitorius,** leaves of which are used medicinally; Kirai means a green or vegetable.

Rábná, meaning reddish, applied in Dinájpur to Race No. 2 of **Corchorus olitorius.**

Rajan or Razan, a name applied in southern Rajputana to more than one species of **Corchorus** including **C. olitorius.**

Rakta bági, meaning deep red bagi, applied in a communication to us from Bákarganj to **Corchorus capsularis,** but probably in error.

Ramua, given by Hem Chunder Kerr as used in Dinajpur for **Corchorus olitorius**; it looks like distorted Marua.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Ranga bogi, meaning coloured bogi, applied to Race No. 5 of **Corchorus olitorius** in Faridpur.

Rangi, meaning coloured, applied to Race No. 21 of **Corchorus capsularis** in western Mymensingh.

Rangri pat, a name said by Hem Chunder Kerr to be used in the 24-Pergannahs.

Sádá Dhakái, said by Hem Chunder Kerr to be used for a race of **Corchorus olitorius** in the 24-Pergannahs.

Sádá pát meaning white jute, generally used in Lower Bengal to denote a green-stemmed race of **Corchorus.**

Sádá titá pát, meaning white bitter jute, applied to Race No. 26 of **Corchorus capsularis** in southern Jessore, the 24-Pergannahs and Howrah.

Sádu pát, meaning white jute, applied to a race of **Corchorus capsularis** in southern Nadia, probably Race No. 26.

San Patwá, applied to Race No. 22 of **Corchorus capsularis** in Purneáh.

Sánchi pat, applied in the 24-Pergannahs to Race No. 26 of **Corchorus capsularis.**

Sánchi Ranga, a name quoted by Hem Chunder Kerr as in use in the 24-Pergannahs, probably refers to Race No. 27 of **Corchorus capsularis.**

Sánchia, applied in Rájsháhi and in Máldá chiefly to green-stemmed races of **Corchorus capsularis**; but it is often used as exactly equivalent to pát. In Pabna it seems to be applied to the race Desoál.

Sári bipli, a name for more than one species of **Corchorus** in the Punjab, among them **C. olitorius.**

Shádá pát, meaning white jute, applied in northern Jessore to a race of **Corchorus capsularis,** see Sádá pát.

Sháni, a name reported from Faridpur for a race of **Corchorus capsularis.**

Shona mukti, meaning golden tipped, a name reported from Bákarganj for a race of **Corchorus capsularis.**

Shukta pata, said by Hem Chunder Kerr to be used in Kamrup.

Sujimani, meaning sun bright jewel, applied to a race of **Corchorus capsularis**, very likely No. 6, in Faridpur.

Sunarong betina, given as the Malayan name for **Corchorus capsularis.**

Sutnalá, meaning thread reed, applied in Faridpur to Race No. 4, but we have found it inconsistently applied also to Race No. 1 in Nadia.

Sutpát, meaning thread jute, applied to Race No. 3 in Faridpur, Bákarganj.

VERNACULAR NAMES FOR ALL KINDS OF THE JUTE PLANTS.

Tarikani Nalita, applied to Race No. 1 of **Corchorus olitorius** in Orissa.

Tati, given by Hem Chunder Kerr as a name for **Corchorus capsularis** in Dinájpur, but probably a misprint of Jati.

Tebra, a word used in Bogra to indicate **Corchorus capsularis**.

Tepári, meaning round, applied in Murshedabád and Nadia to **Corchorus capsularis.** Compare Ghagri.

Thacheka, said by Hem Chunder Kerr to be a name in use in Noákháli.

Titá Mara or Téta Mara guti, said by Hem Chunder Kerr to be applied to **Corchorus capsularis** in Singbhum and also in Nowgong and Lakhimpur.

Titá pát or Teto pata, meaning bitter jute, commonly used in southern Bengal to denote **Corchorus capsularis**.

Tita Sánchia, denotes **Corchorus capsularis** in the district of Máldá.

Tolla, derived from dháula, meaning white, applied to Race No. 4 of **Corchorus olitorius** in western Mymensingh.

Tosa = Tosha.

Toshá, doubtfully derived from dháula (pronounced dhola), meaning white, applied in Pabna to Races Nos. 1 and 2 of **Corchorus olitorius.**

Udhap, meaning bright, is Race No. 4 of **Corchorus capsularis** in Faridpur.

Summary.

SUMMARY.

In the above pages, after briefly enumerating some of the ways in which the two jute plants,—**C. capsularis** and **C. olitorius**—vary in response to external conditions, we have discussed district by district the several races, first of **C. capsularis**, and then of **C. olitorius**, which we are able to distinguish. Our criterion for judging them has been their behaviour in cultivation on the Bardwán Experimental Farm since 1902 and at Pusa during the last two years. We have ended by keeping apart thirty-three races of **C. capsularis** including three only grown to serve as a vegetable, and five races of **C. olitorius.**

That we have kept apart so many races of **C. capsularis** is partly due to the necessity of separating things only somewhat similar pending further study.

The races of **C. capsularis** may be tabulated as follows :—

Early.

Green-stemmed . . { Aus of Mymensingh.
Dháula Bitri of Rangpur = Dháulá Bhádyá of Jalpáiguri, etc., and San Patwá of Purneáh.
Barápát of Mymensingh and Pabna.

SUMMARY.

Red-stemmed	. .	Chhotápát of Mymensingh. Lál Bitri of Rangpur = Lál Bhádyá of Jalpáiguri, etc. = the Meghnál of Purneáh.

MID.

Green-stemmed	. .	Sádá Titá pát of Howrah, Hughli, etc. ? Dháulá Pitá Nalitá of Orissa. Udhap of Faridpur. Desoál of Pabná.
Red-stemmed	. .	Meghlál of Faridpur. Láli or Náiltá of Pabná. ? Lál Titá pát of Howrah, Hughli, etc. ? Nál Pitá Nalitá of Orissa.

LATE.

Green-stemmed	. .	Amon of Faridpur. Sutpát of Faridpur. Belgáchi of Dacca and Faridpur. Dháuleswári of Dacca and Tippera. Desi of Dacca. Deodháli of Tippera. Phuleswári of Tippera. Kákyá Bombái of Pabná and Bográ = Barán of Mymensingh. Dháulá of Rangpur, etc., = Hetiá or Dhala Haimantiá of Dinájpur, etc. Barápát of Cuttack.
Red-stemmed	. .	Kájlá of Dacca and Tipperá. Bidyá Sundar of Dacca and Tipperá. Nál Hetiá of Rangpur, etc.

The races of **C. olitorius** are merely these :—

EARLY.

Green-stemmed	. .	Dháles bogi of Faridpur and Nadia.
Red-stemmed	. .	Lál bogi of Faridpur and Nadia.

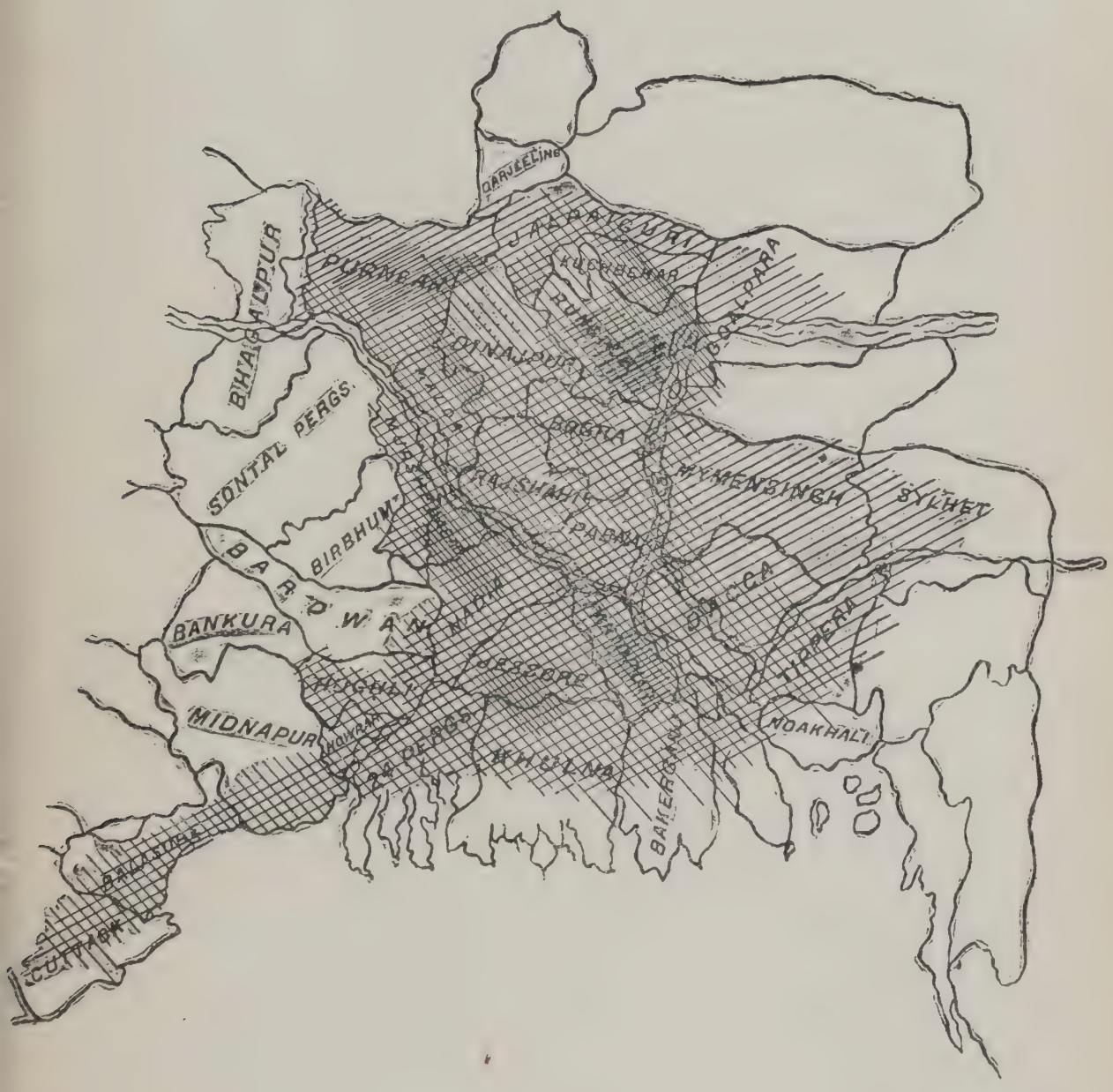
LATE.

Green-stemmed	. .	Desi pát of Hughli = Tosha of Pabna in part.
Red-stemmed	. .	Desi lál pát of Hughli = Tosha of Pabna in part.

VERY LATE. (Doubtful race.)

Red-stemmed	. .	Bodan of Jessore.

It will be at once noted from the above that red-stemmed races are fewer in number than green-stemmed. The curious unexplained local preferences for red-stemmed and green-stemmed races are illustrated in the accompanying map, wherein the shading from right to left indicates the cultivation of green-stemmed plants, and



The Jute area - cross shading in one direction indicates red stemmed races and in the other green stemmed races.

SUMMARY. shading from left to right, the cultivation of red-stemmed plants. The chief areas for red-stemmed plants are in northern Dinájpur, along the lower parts of the Tista river, along the big rivers below Jagannáthganj, Sára and Narsingdi, and near the lower parts of the Bhágirathi and other rivers of the districts of the 24-Pergannahs and Khulna. Except that red so greatly predominates in northern Dinájpur, these areas are all near large rivers. Green-stemmed races prevail to the exclusion of red in the north of the Purneáh and Jalpáiguri districts, in the Dárjeeling Terai and in Mymensingh except its western edge. All these are regions of higher lands.

Early races of **C. capsularis** are chiefly northern, and late races chiefly southern: early races of **C. olitorius** are chiefly confined to the districts of Faridpur and Nadia; while late races occur in the districts round, but chiefly southwards. Late **C. olitorius** is grown nowhere in those northern districts where late races of **C. capsularis** give way to early ones. So that taking both the species together it may be stated that the nearer the crops are to the heart of the delta of the Ganges the later are the races grown.

It is more than probable that the various races grown for fibre have been produced in India by local selection, the ryot having chosen what seemed to him desirable. He has not worked with the intelligence and success that would have attended Western efforts, but still he has worked, and the recognition of the superiority of some races has resulted in the application of curiously hyperbolic names to them.

As a sequel to the work that is embodied in this paper, we have planned and already commenced selection experiments for the evolution of better races, and further we are continuing work upon the points mentioned above as not cleared up. We ask for criticism from those engaged in the jute trade as it is certain to be useful to us.

Those interested in particular districts will find where they are discussed from the following brief index:—

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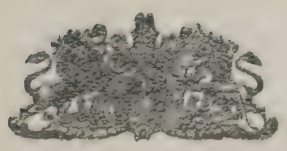

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1908

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I. HENRY BURKILL,

Officiating Reporter on Economic Products to the Government of India.

ERRATA.

No. 2 (1907). Tamarindus indica.—The uses and composition of Tamarind Seeds—

Page 15, line 17 from bottom, *for* Nesbit *read* Nisbet.
,, 16, ,, 8, *for* 1366 *read* 366.
,, 16, ,, 9, *for* Davis *read* Davies.
,, 16, ,, 14, *for* Ramgopul *read* Ramgopaul.
,, 16, ,, 16, *for* Brandt *read* Brannt.

No. 4 (1907). Aleurites moluccana.—The Candle-nut tree :—

Page 33.—Table of Analyses, column 4, *for* De Negre *read* De Negri.

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SALVADORA OLEOIDES.

[*Dictionary of Economic Products, Vol. VI., Pt. II.*, S. 705-6.]

A SHORT ACCOUNT OF SALVADORA FAT.

By DAVID HOOPER, F.C.S., F.L.S.

INTRODUCTORY.

Attention is called in the present *Agricultural Ledger* to a useful solid white fat expressed from the seeds of the Pilu or Jhal (**Salvadora oleoides**, *Dcne*), a small tree or shrub growing in Northern India. The fat is regularly employed in Cutch in the manufacture of bangalas or outer garments of Cutchee ladies, being applied as a "resist" in the process of dyeing. The oil or fat occasionally finds its way to Bombay and is probably used for other purposes. Chemical examination shows that it has a different composition to ordinary Indian fats, and its properties would recommend it for candle making and similar industrial purposes.

The information is given as a supplement to the article on the subject in the *Dictionary of Economic Products of India.*

Salvadora oleoides, *Dcne.*

Syn.—SALVADORA INDICA, *Royle.*

Vernacular names.

Vernacular.—*Pilu, jhal,* HIND.; *Jal, khokar, pinju,* PB., *Kakhan,* MAR.; *Kalawa, karkol, ughai-puttai,* TAM.; *Varagogu,* TEL. The oil : *Kinkanela,* MAR.; *Khakananutela,* GUZ.

Distribution.

Habitat.—The plant is frequent in the Panjáb, Baluchistán, Sind and Bombay. It often forms the greater part of the vegetation of the desert regions, ascending 3,000 feet in the Trans-Indus and 2,400 feet in the salt range. It is very common about Multan and Salsette.

SALVADORA OLEOIDES.

Both **S. oleoides** and **S. persica** grow upon the sea coast of Arabia, Persia and Western India as well as in the arid district of the interior. The differences between the two plants are as follows :—

Compared with S. persica.

S. oleoides.	S. persica.
Leaves—narrow.	Leaves—broad.
Flowers—not stalked.	Flowers—stalked.
Fruits—yellow, in bunches.	Fruits—smaller, red, not densely crowded.

Dr. J. R. Royle considered **S. persica** to be the mustard tree of the New Testament, and says that the Syrian Arabs called it *khardal*, *i.e.*, mustard. It is known in Persia as *darakht-i-miswak* or tooth-brush tree. It is probable that the fat is obtained from the seeds of both species of **Salvadora.**

The Fruits.

The small fruits are globose, $2\frac{1}{2}$ lines in diameter, yellow when ripe, and dark red and brownish when dry. The dried fruits resemble currants and are sweet to the taste.

Harvest of berries.

Early in June, when the fruits ripen, they are collected and eaten as food by the poor, especially in times of scarcity. They prove of considerable value to the poorer classes in Sind, Baluchistán and parts of the Panjáb. In some districts the fruit is abundant enough to attract crowds of villagers who, on payment of a nominal fee, feed themselves and their families on the berries for three or four weeks while they last. Pilu berries are thus regarded as a real staple food, and a bad pilu crop is looked upon as a calamity. In the report of the settlement of the Jhang District in the Panjáb, the Commissioner records the fact that in 1880, there was a magnificent crop of berries that ripened a month earlier than usual and was thoroughly appreciated by the poorer classes. With wheat at 10 to 12 seers (20·6 lbs. to 24·7 lbs.) per rupee (1*s.* 4*d.*) and a harvest below the average they lived for two months among the jhal trees with their flocks and consumed scarcely anything but pilu berries and milk. It was noticed by an officer at Sirsa that the people preferred to eat them by handfuls, seeds and all; but as the latter are apt to accumulate in the intestines they lead to disagreeable results. It is thus evident that in many parts of Northern India a large quantity of seeds are available which could with a little care be collected for sale and for the expression of the oil.

The Seeds.

The seeds are roundish, about one-eighth of an inch in diameter, light brown in colour with dark brown splashes, and a prominent keel or raphe on one side. Within the shell is a pale nutty oleaginous kernel.

Analysis of seeds.

A sample of the seeds obtained from Cutch through the Director, Land Records and Agriculture, Bombay, had the following composition :—

Fat	45·48
* Albuminoids	18·94
Carbohydrates	23·48
Fibre	5·80
† Ash	3·50
Moisture	2·80
	100·00

* Containing nitrogen	3·03
† Containing sand	·30
„ phosphoric anhydride	·71

The seeds yield a fair amount of oil by warm expression. The authors of "Pharmacographia Indica" (1891), found in the seeds, in addition to the oil, a bitter, harsh tasting alkaloid, and a yellow colouring principle giving a deep, bright yellow colour with alkalis.

The Fat.

Nature of the fat.

The seeds yield a fat called kakan, khakhan or kilnel oil. Dr. M. C. Cooke in "Oils and Oil-seeds in the India Museum" (1876) described it as a solid fat of a dull sulphury yellow colour. He adds that under the name of "kikuel" this oil is affirmed to be a product of the Madras Presidency. This statement, however, has not been confirmed. Dr. Dymock says, the oil of **S. oleoides** is of the consistence of butter of a bright green colour and pungent odour. That sold in the bazars, he declares to be usually adulterated, of a greenish-yellow colour and of a greater consistency or hardness than the genuine article. It is used as a stimulant in painful rheumatic affections and after child-birth.

Use of the fat as a "resist."

Fat in dyeing.

The use of **Salvadora** oil in dyeing is described in the "Art of Dyeing in Western India" (1873) by Narayan Daji. The cloth or outer garment of the Cutchee ladies is called a Bangala, and is distinguished by the pattern being a red colour on a black ground. It is prepared in the following manner :—"The cloth is submitted to the safranaceous mixture and galled as for madder-red. The

SALVADORA OLEOIDES.

pattern is now stamped on it with a 'resist' composed of wax one part, and khakan (the semi-fluid oil of the seeds of **Salvadora oleoides**) two parts, melted together. The cloth is now dyed in kayo-black, and the resist removed by boiling the cloth in water. It is then passed through alum liquor, dried, and lastly steeped in a madder or morinda dye-bath, when the red pattern makes its appearance. Red pattern on a charcoal background is executed similarly to the above with the change of chemicals necessary for that tint."

Fat in dyeing.

The Dewan of Cutch, in 1902, sent to the Indian Museum, Calcutta, a series of coloured cloths prepared by the wax-resist process, and at the request of the Reporter on Economic Products supplied the following information explaining the vernacular names they bore in that district.

"The cloth used for dyeing must be white in colour for all the four varieties, *jagannathi*, *madharpat*, *malmal* and *nansukh*. They are all without exception first dipped into sesame oil and then kept in water for four days. On the fifth day they are washed with *harda* or myrobalams and alum water. The borders and ends of the cloth are then printed with a mixture of wax and oil. If *Bagidas* Nos. 1 and 2 are to be made, the cloths are dipped into a mixture of iron sulphate and kaiyo. This brings out the patterns known as *Sallo minia* and *Bagida kalo*. They differ only in lengths, the former is 11 to 12 *gajs* long, and the latter $6\frac{3}{4}$ *gajs*, (a Cutch gaj is about 16 inches in length).

"If *Rehtabhat sallo* and *Nagaria sallo* are to be made, the cloths are treated with wax printing as before and washed in kaiyo, the borders and ends of the cloth are coloured with red aniline dye locally called 'alijar,' which converts the wax printing into a red colour. At this stage the cloth is called *Rehtabhat sallo* or *Nagaria bagedo*. The difference in the two is only in the nature of the printing. If the borders and ends are coloured red the cloth is *Rehtabhat sallo*. If the printing on the borders and at the ends consists of a number of red spots or small circles with five clusters thereof in the interior the cloth is called *Nagaria sallo*. The name *Nagaria* is derived from similar cloth received in olden days from Jamnagar."

Price of oil.

The price of khakan oil in Guzerat in 1873 was three annas (3*d*.) a seer (about 2 lbs.) The Diwan of Cutch charged only R2 (2*s*. 8*d*.) for 5 lbs. of **Salvadora** seeds and 10 lbs. of the solid fat. At such a low price the fat is worthy of a larger trade.

Chemical Examination of Fat.

Khakan fat occurs in blocks of a yellowish-white colour, solid at ordinary Indian temperatures with a slightly rancid odour. A

SALVADORA OLEOIDES.

small quantity of the seeds extracted with ether left a light greenish fat which readily bleached on exposure to the air. The following chemical and physical constants were obtained with the commercial fat from Cutch and agreed with those obtained with the oil experimentally extracted from the seed by solvents.

Constants of the oil.

Sp. Gr. at 50°C.	·9084
Melting point	41°C.
Acid value	11·26
Saponification value	242·36
Iodine value	7·48
Reichert-Meissl value	1·28
Fatty acids per cent.	94·12
Melting point of	40°C.
Acid value of	244·42
Iodine value of	8·3

Saponification.

The fat saponifies with ease. The low iodine value and the high saponification value distinguish this fat at once from white fats found in India, such as Malabar tallow **(Vateria indica)** and Kokam butter (**Garcinia indica**). The iodine value indicates the presence of less than ten per cent. of oleic acid. The high saponification value indicates the presence of lauric or myristic acids. The fat has a higher melting point than coconut oil, palm oil and cocoa butter, and should for this reason prove of great use for the manufacture of candles and hard soaps. A pure white fat of this description would also be adapted for the preparation of ointments, suppositories and other medicinal requisites.

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DYES FROM FLOWERS.

A summary of our present knowledge regarding the use of Dyes from Flowers in India, by I. H. BURKILL, *together with two reports on* Thespesia Lampas *and* Hibiscus Sabdariffa, *by* A. G. PERKIN.

FLOWERS YIELDING DYES.

Flower colours as a rule have no connection with dyeing; and although it happens that certain are used in India by dyers, it would be the greatest of mistakes to expect flowers as a class to dye. The common yellow colouring matters of flowers—collectively called carotin—are proved to be useless industrially. The flowers which find use in India are:—

Division (i)—those in which the bright parts of the flower hold the dye—

Dhák tree or Palás (**Butea superba,** *Roxb.*, and **B. frondosa,** *Roxb.*)
Coral tree (**Erythrina indica,** *Lam.*)
Safflower or Kusum (**Carthamus tinctorius,** *Linn.*)
Marigolds or Genda (**Tagetes erecta,** *Linn.*, and **T. patula,** *Linn.*)
Harsinghár (**Nyctanthes Arbor-tristis,** *Linn.*)
Saffron (**Crocus sativus,** *Linn.*)
Balsam (**Impatiens Balsamina,** *Linn.*)

Division (ii)—those in which the dye is found as much in the other parts of the flowers as in the petals—

Asbarg (**Delphinium Zalil,** *Aitch. et Hemsl.*)
Tún or Gulnári (**Cedrela Toona,** *Roxb.*)
Rozelle or Patwa (**Hibiscus Sabdariffa,** *Linn.*)
Dhái or Dáwi (**Woodfordia floribunda,** *Salisb.*)

The following table shows where these flowers are used according to our present knowledge:—

	Himalaya.	North Western India including Sind and Punjab.	Gangetic plains.	Lower Bengal and Assam.	Burma.	Deccan with Central India, etc.	Bombay Coast.	Madras.
Delphinium Zalil.	.....	in chief centres	in chief centres	.....	.....	in Poona .	in chief centres	
Cotton .	.....	Hyderabad Jacobabad.	Mainpuri .	.....	.....	.....	.....	
Hibiscus Sabdariffa.	.....	.....	.....	.....	Shans . .	Chutia Nagpur	.....	
Erythrina .	.....	.....	.....	Hugli, Assam .	.....	.....	.....	
Butea . .	Kashmir Almora.	General . .	General .	General but not greatly used.	General but not greatly used.	Fairly general	Apparently general at least from Bombay northwards.	
Cedrela Toona.	.....	Somewhat general.	Somewhat general.	Sparingly in Bengal.	S. Shan States	Mysore, Coorg.	Used.	
Woodfordia floribunda.	General in North-west	General . .	General . .	Somewhat general in Bengal.	General .	General . .	General . .	Apparently general.
Tagetes .	Almora .	Lahore . .	Somewhat used generally.	.....	.....	Chutia Nagpur	Rarely if ever now.	
Carthamus .	.....	Greatly declined but used somewhat.	Greatly declined but used sparingly in most parts.	Greatly declined but used sparingly in most parts.	Used a little	Declining but fairly general.	Generally used but declining.	Used.
Nyctanthes .	Almora .	.....	Fairly general .	In several places but sparingly used.	.....	Fairly general	Fairly general	North Arcot. (Used also in Ceylon.)
Saffron . .	Kashmir .	Imported but despite statements to the contrary apparently but little used as a dye.	Imported but hardly for use as a dye.	Imported but doubtful if used as a dye except on occasion of great ceremony.	Said to be imported.	Imported but for other purposes than dyeing.	Imported but for other purposes than dyeing.	Imported but for other purposes than dyeing.

FLOWERS USED.

These are all the flowers actually used in dyeing in India. Of others that could be used, we know two,—both from the excellent work of Mr. A. G. Perkin. They are **Hibiscus Sabdariffa,** *Linn.*, petals—not the whole flower—and **Thespesia Lampas,** *Dalz. et Gibs.* Two preliminary reports on them which have reached me are printed below.

Meagreness of literature.

It is difficult to ascertain from the literature available if and where flower-petals are used for dyeing in foreign countries as in India. Europe of course has used for long saffron and safflower, both of which came from the East: and China and Japan have had a trade with Europe in the flower-buds of **Sophora japonica** which contain a yellow dye: but beyond these three which are in no way obscure products, it is not improbable that in various countries of the world, flowers which are of no account in the European art of dyeing, have been or are used as in India.

CHEMISTRY OF THESE DYES.

The chemical natures of the dyeing substances in the above-named flowers have been but in part investigated.

Cotton.

Cotton has been investigated by A. G. Perkin (*Trans. Chem. Soc.*, 1899, pp. 825-829) and he names the dye present "gossypetin."

Erythrina

Erythrina has not been investigated.

Butea.

Butea flowers have been investigated by Hummel, Cavallo and A. G. Perkin (*Proc. Chem. Soc.*, 1894, p. 11; xix, 1903, p. 134 and xx, 1904 p. 169): two allied bodies were found called respectively "butin" and "butein"; butin in the flower is colourless, and butein is bright orange yellow.

Marigold.

Tagetes was investigated, first by Latour and Magnin de la Souce, and afterwards by A. G. Perkin (*Bull. Soc. Chem.*, xxviii, 1877, p. 337 and *Proc. Chem. Soc.*, xviii, 1902, p. 75). It contains a substance called "quercetagetin."

Safflower.

Carthamus flowers when used in dyeing are first soaked in water that the soluble safflower yellow may be extracted; thereafter the undissolved red carthamin is withdrawn for use by means of alkali. It is a long time now since Schlieper's work on these two dyes was done (*Annales*, lviii, 1846, p. 357) and further work is called for.

Harsinghar.

Nyctanthes flowers have recently been investigated in part (see postscript on p. 29). The dye in them is not extracted from the corolla-lobes but from the corolla-tubes.

Saffron.

Saffron has received a good deal of attention, a result of its former wide use in Europe. The part of the flower used for dyeing is the stigma only; chopped-up petals being an adulterant which is

CHEMISTRY. not uncommon. The colouring matter in saffron is "Crocin" (see Rochleder and Meyer, in *Journ. Prakt. Chem.*, lxxiv, p. 1, Weiss, in ditto, ci, p. 65, Kayser in *Ber. d. deutsch. Chem. Gesellsch.*, xvii, 1884, p. 2228, Schunck and Marchlewski in *Liebig's Annalen* cclxxviii, p. 349 and lastly Schueler ex *Bot. Centralblatt*, lxxxvii, 1901, p. 152).

Balsam. The colouring matter of **Impatiens** is quite uninvestigated. In a note in the *Journal of the Asiatic Society of Bengal*, 1907, p. 565, I put on record all that I then knew about its use as a dye: but since that was done I have had the good fortune to light on the following statement made by Consul-General Sir A. Hosie, (*Report on the Province of Szechuan*, 1904, p. 42): "**Impatiens Balsamina** or Chih-chia Hua—the Finger-nail flower—derives its name from the fact that a decoction of its petals is used by ladies for tinting their finger-nails "red." It is extremely interesting that the Chins on the Pi-choung in Northern Arakan should use the plant much as do the ladies of South-Western China.

Asbarg. The colouring matter of **Delphinium Zalil** has been the subject of a thorough enquiry by A. G. Perkin and J. A. Pilgrim (*Trans. Chem. Soc.*, 1898, pp. 267-275). The dyeing substances are three;—"quercetin," "isorhamnetin" and a third body, in small quantity, probably nearly allied to quercetin.

Cedrela flowers have not been investigated.

Woodfordia. In the flowers of **Woodfordia** is a great quantity of tannin associated with some colouring matter which has not been investigated.

Patwa. The rose-red colouring matter of **Hibiscus Sabdariffa** is also unstudied; but rose-red colouring matters from the petals of some of its allies have been investigated in part at least, though not enough to enable the substance to be named. The flowers of **Hibiscus Sabdariffa** are reported to contain two substances. Mr. Perkin believes one to be a new colouring body of the flavon group, while the other resembles gossypetin.

Thespesia. The flowers of **Thespesia Lampas** are reported to contain "quercetin."

CLASSIFICATION OF DYEING SUBSTANCES. I wish to show by giving a classification of these colouring matters that they are not of one group, and that we are dealing with many chemical substances partly allied and partly not: in adding after the names of the plants their natural orders, I wish further to show that these dyeing substances occur with such irregularity as at present to give us little indication where we might expect to find others.

We may class the dyeing bodies with Czapek (Biochemie der Pflanzen, Jena, ii, 1905) thus:— CHEMISTRY.

Carotin group of substances

Crocin of **Crocus sativus** (IRIDACEÆ).

Flavon group of substances

Division 1. Quercetin of **Delphinium Zalil** (RANUNCULACEÆ).

,, of **Thespesia Lampas** (MALVACEÆ).

Isorhamnetin of **Delphinium Zalil.**

Gossypetin of **Gossypium** (MALVACEÆ).

,, of **Hibiscus Sabdariffa** (MALVACEÆ).

Rutin or Sophorin of **Sophora japonica** (LEGUMINOSÆ).

Quercetagetin of **Tagetes** (COMPOSITÆ).

Division 2. Butein from **Butea frondosa** (LEGUMINOSÆ).

Not yet to be classed.

Carthamin from **Carthamus tinctorius.**

It will have been seen that most of the flower dyes belong to the group of substances which contains quercetin. Quercetin is common in the plant kingdom: it occurs in a great variety of plants and in a variety of places in them. It occurs in leaves as in the Vine, in bark as in the apple, in berries as in **Rhamnus** and in flowers as in **Cornus.** It occurs in combination in various ways in many more plants where it does not occur free: Quercitrin found in oak-bark is one combination: Rutin which comes from rue flowers and leaves, buds of **Sophora japonica** and Violet flowers is another.

Among the substances of the Flavon group are a few good dyes; and the dyeing materials containing them are in demand in Europe, *e.g.*, 'Persian Berries.'

Butein exists in flowers of **Butea** as a compound—a glucoside—decomposed by boiling and thereon yielding the true dye.

It is rather probable that chemical substances of the flavon group are products of the activity of the plant which are not further directly required for its growth, but their great variety and peculiar production suggest that they are not altogether waste, and have some relation, perhaps occasionally protective, to the economy of the particular plants which produce them. And again as this is the position of our knowledge we are prevented from anticipating the conditions of the plants wherein they might profitably be sought. This much we know that they exist in the cell sap of living cells and that from old dead wood, though they may have been present in the young living wood, they are no longer extractable.

GROWTH OF KNOWLEDGE.

Asbarg.

Delphinium Zalil as an Indian dye was first mentioned under its Sindhi name by Stocks in the *Transactions of the Medical and Physical Society of Bombay*, iii, N. S., 1855-56, p. 149. In 1868 Baden-Powell (*Punjáb Products*, p. 323), mentioned it as sold in Amritsar and Pesháwar. Stewart (*Punjáb Plants*, p. 4) in the next year mentioned it as used in Multan. He suspected that the source might be **Delphinium saniculæfolium.** Buck in 1878 (*Dyes and Tans of the North-Western Provinces*, p. 44) suggested the European **D. Ajacis** as the source of the bazaar-product. Murray (*Plants and Drugs of Sind*, 1881, p. 73) dropping Stewart's query, ascribed it boldly to **Delphinium saniculæfolium.** Liotard (*Memorandum on Dyes of Indian Growth*, 1881, p. 89) suggested, after Sir Edward Buck, that it is **D. Ajacis** which gives the dye; but he also (p. 94) names **D. speciosa** as the source of the isbarg of Siálkot and Gujránwála. Dymock (*Vegetable Materia Medica of Western India*, 1885, p. 14) followed Murray and at the same time mentioned its use in Bombay as a dye for silk.

In 1885 Aitchison as a result of his wide wanderings on the Afghan Boundary Commission, was able in conjunction with Mr. W. B. Hemsley of the Royal Botanic Gardens, Kew, to determine the true origin as a new **Delphinium—D. Zalil**—which "forms a great proportion of the herbage of the rolling downs of the Badghis" in Western Afghánistán. In 1889 this name was taken up in Dymock, Warden and Hooper's *Pharmacographia indica*, p. 23, and in 1890 in Sir George Watt's *Dictionary of the Economic Products of India*. Since then, with two exceptions, writers have been clear regarding the origin of the dye.

Fawcett in his *Monograph on Dyes and Dyeing in the Bombay Presidency*, 1896, p. 17, mentions its use in the jails of that Presidency, *e.g.*, Shikárpur, and in the towns of Poona, Surat, etc. Munshi Saiyid M. Hadi mentions its use (but without saying where) in the United Provinces (*Monograph on Dyes and Dyeing in the North-Western Provinces*, 1896, p. 82). Sir Thomas Wardle in 1886 did some dyeing experiments (*Report on Dye-stuffs of India*), obtaining by various processes on silk and wool delicate yellows, a dull yellow and a greenish yellow. To his results we shall shortly return.

Cotton.

Cotton flowers are first mentioned as a dye by Liotard in his *Memorandum on Dyes of Indian Growth*, 1881, Appendix, p. iii., as being used in the Mainpuri district. Sir Thomas Wardle when specimens were required for his investigations got them from Jacobábád and Hyderábád in Sind. From these places alone is such a use reported. Perkin accidentally substituted Manipur for Mainpuri in the *Transactions of the Chemical Society*, 1899, p. 825.

and the same substitution was copied into the *Technical Reports and Scientific Papers of the Imperial Institute*, 1903, pp. 216 and 222.* GROWTH OF KNOWLEDGE.

Hibiscus Sabdariffa has fleshy red calyces and pale yellow flowers. The yellow flowers are just capable of dyeing yellow, but are not used at all in India: the red calyces are used in a very obscure degree in two remote parts of the country, and the observation of it long escaped detection. Their use in Chutiá Nágpur was made known by the Rev. A. Campbell in his *Descriptive Catalogue of the Economic Products of Chutiá Nágpur sent to the Colonial and Indian Exhibition*, 1886, p. 10—a mere mention; and their use among the Shans was made known by Leveson in *A Note on Dyes and Dyeing in the Southern Shan States*, 1896, p. 8. Patwa—Hibiscus Sabdariffa.

Sir William Jones, first in European literature (*Asiatic Researches*, iv, 1798, p. 289), made mention of the yellow dye of the flowers of **Cedrela Toona,** and not for many years do we find it mentioned again. The next two occasions on which mention was made, were when Lindley and Moore in their *Treasury of Botany*, i, 1866, p. 243, wrote that a red dye is yielded by the flowers, and two years later when Baden Powell (*Punjáb Products*, i, 1868, p. 448) wrote of a yellow dye yielded by the flowers, and obtained by him from the bazaars of Ambálá, Kángrá, Amritsar, Lahore and Patiála. Stewart (*Punjáb Plants*, 1869, p. 34), Sir Dietrich Brandis (*Forest Flora, North-West and Central India*, 1874, p. 73) and others thereafter mentioned it. In the *Report of the Land Revenue Settlement, Hazára*, 1876, p. 11, its use in that district is given. In 1877 in the *Gazetteer of Mysore and Coorg*, i, p. 51, its use there is given. Sir Edward Buck (*Dyes and Tans of the North-Western Provinces*, 1878, p. 28) gives the method of dyeing with it in Cawnpur and Farukhábád. Liotard (*Memorandum on Dyes of Indian Growth*, 1881, p. 82) adds a little information to this. M'Cann (*Dyes and Tans of Bengal*, 1883, p. 73) names Lohárdagá, Patná, Sáran, Darbhangáh and Monghyr as places where the dye is used, but sparingly: "it is scarcely a marketable commodity," he says. In the *Bombay Gazetteer*, xv, 1883, p. 66, the use of the dye in Kánara is superficially mentioned, and in vol. xxv, 1886, p. 241, a general statement is made that it is used in the Bombay Presidency. Sir George Watt in his *Guide to the Economic and Commercial Court*, 1886, p. 283, adds a statement that it is used in Burma. Saiyid Mohammed Hadi in his *Monograph on Dyes and Dyeing in the North-Western Provinces*, Cedrela Toona.

* The cotton flowers examined by Mr. A. G. Perkin came from Cawnpur. They were collected specially, and were not a bazaar sample.

GROWTH OF KNOWLEDGE.

1896, p. 79, states how it is sometimes used in conjunction with turmeric, and Nagendra Náth Banerjee, *Monograph on Dyes and Dyeing in Bengal*, 1896, p. 26, describes a method of dyeing in Muzaffarpur and remarks how rarely it is used. Duncan in his *Monograph on Dyes and Dyeing in Assam*, 1896, p. 18, expressly says that it is not used in that province.

Sir Thomas Wardle experimented with it.

Dhak or Butea.

Sir William Jones, and Buchanan-Hamilton well knew the use of the flowers of **Butea frondosa** (*see Asiatic Researches*, iv, 1798, p. 308, and *Statistical Account of Dinájpur*, written in 1807 and reproduced in Montgomery Martin's *Eastern India*, i, 1838, p. 237; Roxburgh also knew how the flowers dye (*Flora indica*, ii, 194). Again in 1826, Ainslie (*Materia Medica*, ii, p. 335) wrote of the use of the dye. In 1841 Irvine (*General and Medical Topography of Ajmir*, p. 203) mentions dyeing as practised with them in Ajmir. Voigt, who wrote from Serámpur, in 1845 (*Hortus suburbanus*, p. 238) mentions the dye as done on cotton previously prepared with alum when it gives a yellow colour, which may be changed by alkali into a deep reddish orange. Walter Elliot in his *Flora Andhrica*, p. 183, mentions the dye as used by the Telegus. Baden Powell (*Punjáb Products*, 1868, p. 370) made known its use in the Punjáb. Stewart following him (*Punjáb Plants*, 1869, p. 60) says 'the flowers are used in dyeing basanti, a fleeting yellow, in preparing the Holi powder.'

An extract from the Records of the Government of India published in the *Journal of the Agricultural and Horticultural Society of India*, ix, 1857, Selections, p. 54, states that the dye was well known in Burma.

I shall now take the references province by province, beginning with the North-West of India.

In regard to Kashmir, Baden Powell (*Punjáb Products*, 1868, p. 448) records its use: and Atkinson records its use in the Himálayan districts of the North-Western Provinces (*Gazetteer*, 1882, x, p. 798).

Its use in the Punjáb plains is universal. It is recorded by Baden Powell (*Punjáb Products*, 1868, p. 448) that it was in his time known to him to be used in the districts of Rohtak, Gujrát, Ambálá, Jhelum, Jálandhar, Sháhpur, Kángra, Gugera, Gujránwála, Dera Ghází Khán and in Kapúrthala State. Its use is recorded for the Montgomery district in the *Report on the Settlement*, 1878, p. 18, and in the *Gazetteer*, 1884, p. 18.

Sir Denzil Ibbetson (*Settlement Report*, 1883, p. 10) recorded its use in Karnál. Its use in Amritsar was recorded in the *Gazetteer*,

2nd edition, 1893, p. 8, and in Múltán in the *Gazetteer*, 1884, p. 10).

Liotard, *Memorandum on Dyes of Indian Growth*, 1881, p. 79, recorded its use in the districts of Ludhiána, Hoshiárpur, Amritsar, Gurdáspur, Lahore, Gujránwála, Jhelum, Gujrát, Sháhpur, Jhang, and Montgomery as well as some of those named above.

In the United Provinces according to Sir Edward Buck (*Dyes and Tans of the North-Western Provinces*, 1878) its use is also general; and it is further mentioned as used in the Bijnaur district in the *Settlement Report*, 1874, for that district, p. 12.

Its use in Bombay is recorded as occurring in the following:—Thána district (*Gazetteer*, xiii, p. 26), Kánara district (ditto, xv, p. 64), Poona district (ditto, xviii, p. 50), Baroda State (ditto, vii, 1883, p. 41) and Gujrát (ditto, xxv, 1886, p. 243). It is recorded also for the Savant Vádi State (*Catalogue of the Westropp Museum*, 1888, p. 88).

That it is used in the Nizám's Dominions, is stated by Liotard (*Memorandum on Dyes of Indian Growth*, 1881, p. 80) and by Biscoe (*List of Hyderábád Trees*, 1895, p. 4).

Regarding Madras it appears to be used in the Trichinopoly district (Moore, *Manual of the Trichinopoly district*, 1878, p. 76) but the author is not very explicit. It is recorded as used in the North Arcot district (Cox, *Manual of the North Arcot district*, revised by H. A. Stuart, i, 1895, p. 27). Liotard records that it is used in Mysore (*Memorandum on Dyes of Indian Growth*, 1881, p. 80).

In the Central Provinces its use is confirmed in the Chándá district by the *Report on the Land Revenue Settlement*, 1869, p. vi, Appendix, and the similar *Report on the Settlement of the Upper Godavery district*, 1869, p. 38, and in the Mandlá district (*Report on the Land Settlement of the Mundlah district*, 1870, p. 88), and also in the Damóh district (Russell, in *Central Provinces District Gazetteers*, 1906, p. 8). I can add that it is used in Berár, in the Amráoti district, on the authority of information in my office.

Its use in Bengal is recorded thus:—Palámau, Bhagalpur, Patná, Monghyr, Mánbhúm, Cuttack, Lohárdagá, Sáran, and Puri (M'Cann, *Dyes and Tans of Bengal*, 1883, p. 73), Dárjíling Terai (Gamble, *List of Trees and Shrubs of the Darjeeling District*, 1878, p. 27), Chutiá Nágpur (Campbell, *Descriptive Catalogue of the Economic Products sent to the Colonial and Indian Exhibition*, 1886, p. 5), and Cuttack district (Nagendra Náth

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Banerjee, *Report on the Agriculture of the District of Cuttack*, 1893, p. 200).

In Eastern Bengal it is known to be used in Dinájpur and Chittagong (M'Cann, *Dyes and Tans of Bengal*, 1883, p. 74). Darrah in his *Notes on Cotton in Assam*, 1885, p. 35, mentions its use without saying where.

It is recorded as used in the Minbu district of Burma by Captain A. T. Gage, in the *Records of the Botanic Survey of India*, 1904, p. 135.

Sir Thomas Wardle did many experiments with **Butea** flowers and Professor E. Watson has done others. Sir Thomas Wardle (*Report on the Dyes and Tans of India*, 1887, pp. 7, 20, 36-38 and 51) tried the dye of flowers from Hyderábád, Sind, and the Central Provinces on silk, cotton and wool and got various shades of yellow and bright orange. He remarks that they are rich in colouring matter and will produce bright and strong shades. Further information about these experiments will follow later.

Coral tree—Erythrina indica.

Erythrina indica is a sea-coast tree, which occurs wild in but a few places inland; however it is readily cultivated in many places. Its flowers are very little used. M'Cann (*Dyes and Tans of Bengal*, 1883, p. 66), says briefly "this tree is mentioned in the report from Húghlí as producing a red dye. The flowers are collected about the end of February, and when dried and boiled in water yielded a red dye."

It is again mentioned by Darrah (*Note on Cotton in Assam*, 1885, p. 33) as yielding (he does not say where) a red dye.

No one else mentions such a use.

Dhai—Woodfordia floribunda.

Woodfordia floribunda grows everywhere in India except on the plains of Lower Bengal: it generally flowers profusely, and consequently, the dye is usually procurable with little trouble. Roxburgh mentions the use of the flowers as dye, and so does Buchanan-Hamilton who saw them sold in 1813 at Lálganj in the district of Gorakhpur (Montgomery Martin, *Eastern India*, ii, 1838, p. 521). Irvine mentions their use as a dye in his book entitled "*Some Account of the General and Medical Topography of Ajmeer*," 1841, p. 133. Honigberger, in 1852 (*Thirty-five Years in the East*, ii, p. 282) recorded its use in Lahore as a dye. In 1865 J. L. Stewart wrote (*Journal Agri. Hort. Soc.*, xiii, p. 307) of the collection under the Siwaliks near Bijnaur and export thence for dyeing. In 1859 Stewart again mentions its use in a "Journal of a Tour in Hazára and Khághán" (*Journal Agri. Hort. Soc. India*, xiv, p. 15). Birdwood mentioned it in his *Catalogue of Vegetable Products of*

the Presidency of Bombay, 1865, p. 298. In 1873 Drury (*Useful Plants of India*, p. 236) called attention to a considerable trade of it from the hills of Khándesh. Its use is mentioned in the Records of the Government of India, quoted in the *Journal of the Agricultural and Horticultural Society*, ix, 1857, p. 54. After these dates many writers mention it.

Upon its use on the North-Western Frontier, Stewart's statement regarding Hazára has been quoted. Sir Dietrich Brandis mentions it in his *Forest Flora of the North-West and Central India*, 1874, p. 238, as collected beyond the Indus for use in the Punjáb. In the Punjáb its use in the Sutlej valley is mentioned in the *Journal of the Agricultural and Horticultural Society of India*, xii, 1865, p. 391, and in the Salt range (*ibid*, New Series, 1869, p. 89). Its use is again mentioned in the *Gazetteer of the Ráwal Pindi district*, 1884, p. 15.

Its use in Rájputána, we know from Irvine as quoted, and again from Sir George King in the *Indian Forester*, iv, 1879, p. 228. I have received flowers from the Political Agent, Bhopáwar, who records in a letter their use as a dye.

In the United Provinces, Sir Edward Buck names it (*Dyes and Tans of the North-Western Provinces*, 1875, p. 37), and gives the quantity brought to the plains from Bijnaur, Rehar, Garhwál and Kumáon in the years 1874-75 and 1875-76. Atkinson (*Gazetteer, Himálayan Districts*, 1882, p. 778) again mentions the considerable export. Saiyid Mohammed Hadi in his *Monograph on Dyes and Dyeing, North-Western Provinces and Oudh*, 1896, p. 81, mentions the dye in passing.

In Bengal the extent of its use is set forth by M'Cann (*Dyes and Tans of Bengal*, 1883, p. 153). Nagendra Náth Banerjee (*Report on the Agriculture of the District of Cuttack*, 1893, p. 49) says that it is hardly used as a dye in Cuttack; however in his *Monograph on Dyes and Dyeing in Bengal*, 1896, p. 33, he gives an account of the way in which it is used in Serámpur. Claude J. Dumaine (List of Timber Trees and useful Plants of the Hazáribágh Zillah Forests in *Journal Agri. Hort. Soc.*, ii, 1870, p. 229) names it as a Chutiá Nágpur dye. Rev. A. Campbell gives explicit information when he writes (*Descriptive Catalogue of the Economic Products of Chutiá Nágpur sent to the Colonial Exhibition in London*, 1886, p. 3) the flowers are exported in large quantities to Patná and Cawnpur.

Regarding the Central Provinces, its use in Hoshangábád was mentioned in the *Settlement Report* of 1865, p. 180, and its use in the Ráipur district (*Settlement Report*, 1869, p. 76). Russell in his

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Monograph on the Dyeing Industry of the Central Provinces, 1896, pp. 6-7, gives an account of its use.

In Bombay, it is collected in Khándesh, and in the Panch Maháls (*Gazetteer*, iii, 1879, p. 203) Fawcett, *Monograph on Dyes and Dyeing, Bombay*, 1896, p. 15, describes its use. Talbot (*List of Trees, Shrubs, etc.*, 1902, p. 174) mentions the dye.

Upon its use in the Nizám's Dominions, we have as authority Biscoe alone (*List of Hyderábád Trees*, 1895, p. 15).

Its use in Madras is mentioned in the *Manual of the Madras Administration*, i, 1885, p. 313.

In Burma its use was made known in 1857 as quoted. Kurz mentions it again (*Forest Flora of British Burma*, i, 1877, p. 518), but in the *British Burma Gazetteer*, i, 1880, p. 128, is a statement to the effect that the dye was little known. Does this mean in Pegu or to Europeans?

Sir Thomas Wardle experimented with it.

Safflower—Carthamus tinctorius.

It is not necessary to say very much about Safflower here, as a great deal of information is readily available in the *Agricultural Ledger* No. 11 of 1904, entitled "*Carthamus tinctorius*—Safflower, a digest of correspondence conducted by the Office of the Reporter on Economic Products," by R. Abbey-Yates. The use of the dye has greatly decreased during the past quarter of a century; its export from India is greatly reduced. The dye is in demand for religious observances and ceremonies; auspicious marrying seasons still cause some fluctuation in local prices. Everywhere throughout India the use of the dye is known.

Baden Powell in his *Punjáb Products*, 1868, pp. 447-448, names the dye as having been sent to him from most of the districts of the Punjáb and he gives the shades produced by it. Pandit Bhág Rám in his *Report on Dye-stuffs of Indian Production* details its use in Ajmir. Sir Edward Buck gives full information on its use in the United Provinces (*Dyes and Tans of the North-Western Provinces*, 1878, pp. 11-15), and further information can be gathered from Saiyid M. Hadi's *Monograph on Dyes and Dyeing in the North-Western Provinces and Oudh*, 1896, pp. 76-77.

For the Bengals, reference may be made to M'Cann's *Dyes and Tans of Bengal*, 1883, pp. 4-17, and to Nagendra Náth Banerjee's *Monograph on Dyes and Dyeing in Bengal*, 1896, pp. 16, 22, and 38.

Regarding its use in Assam reference may be made to Duncan's *Monograph on Dyes and Dyeing*, 1896, pp. 17-18.

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For the Central Provinces, reference may be made to Russell's *Monograph on the Dyeing Industry of the Central Provinces*, 1896, p. 13 and for Berar to B. B. Sule, *Monograph on Dyes and Dyeing in the Hyderábád Assigned Districts*, 1896, pp. 2-3.

Regarding Bombay, Liotard (*Memorandum on Dyes of Indian Growth and Production*, 1881, pp. 21-32) gives some information, and a most interesting account is to be found in the *Bombay Gazetteer*, xvi, 1883, pp. 172-175, of dyeing with it at Násik. In Fawcett's *Monograph on Dyes and Dyeing in the Bombay Presidency* is full information.

Liotard (*loc. cit.*) gives some information regarding Madras and a little more is to be found in Holder's *Monograph on Dyes and Dyeing in the Madras Presidency*, 1896, p. 3.

Liotard (*loc. cit.*) also offers a very little information regarding Burma. Theobald in Mason's *Burma, its People and Products*, ii, 1883, p. 396, offers a little more, explaining how general is its use.

Sir Thomas Wardle made experiment with this dye. Watson has also examined the dye.

Marigolds—Tagetes spp.

The two plants **Tagetes erecta** and **patula** are natives of America, whence they were introduced into European gardens and then from Europe into India. The ease with which they can be grown and the favour of their colour for sacred uses, must soon have made them to be spread widely in India; and probably in Upper India it was discovered that the flowers would dye. Those who used **Butea** must have discovered the dye of **Tagetes.**

In modern literature Atkinson (*Gazetteer of the North-Western Provinces, Himálayan Districts*, p. 778) first records that, "the flowers yield a yellow dye which is but little used except by the poor." Baden Powell (*Punjáb Products*, 1868, p. 358) mentions their use in the Punjáb: Buck and Liotard mention their use in the United Provinces in detail (*Dyes and Tans of the North-Western Provinces*, 1878, p. 29, and *Memorandum on Dyes of Indian Growth*, 1881, p. ii, Appendix.) "The dye is extracted from the flowers in the same manner as from the dhák (**Butea frondosa**): they are soaked in water, and squeezed by hand. The dye is but little used by dyers, though the common people not unfrequently dye their own clothes with it. The shade of yellow known as 'gendia' is produced by it, and it is occasionally used in place of harsinghur or turmeric in producing the colour 'champai.'"

M'Cann (*Dyes and Tans of Bengal*, p. 140) found that **Tagetes patula** flowers were used in Lohárdagá to give with an alum mordant a dull green colour.

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There are no explicit records of its use in other parts of India. Several writers happen to mention its use but merely in quotations from those named above, Duncan alone (*Monograph on Dyes and Dyeing in Assam*, 1896, p. 51) certifies that to his knowledge it had no use as a dye in Assam.

Sir Thomas Wardle experimented with it on silk and wool, and says that he found the flower to contain a moderate amount of colouring matter and to produce by different processes used various colours all containing more or less of a yellow element. His specimens are preserved in the Indian Museum and we shall return to them later.

Harsinghar—Nyctanthes Arbor-tristis.

Nyctanthes Arbor-tristis is a native of India, and is very abundant wild in the Terai and forests on the lower slopes of the Himálaya. Southwards it becomes less common wild than cultivated; consequently the supply of its flowers for dyeing diminishes southwards. Unless it be that writers on southern products have overlooked the use of the plant, the following references distinctly indicate that as a dye the Tamils, and their neighbours do not use it as do the dwellers in Northern India. Cooke in his *Flora of Bombay*, ii, 1904, p. 116, doubts if it be wild in that Presidency: however several writers on the forests of the Central Provinces speak of it as a useful forest product.

Linschoten who travelled about Gujrát in the sixteenth century found out that the flowers are used as a dye. He says (*Voyage of John Huyghen van Linschoten to the East Indies*, edited by Burnell, Tiek and Yule, 1885, p. 58) "the flowers . . . in India they use for saffron, therewith to dresse their meats and to die with all as [we doe] with our Saffron."

Nyctanthes Arbor-tristis yields the yellow dye from more than its corolla-tubes:—thus Buchanan-Hamilton found the bark to be used by garland-makers at Dinájpur, Eastern Bengal, in 1807, to give a yellow colour to sola pith where Safflower or Kusum is now generally used in Bengal at least (Montgomery Martin, *Eastern India*, 1838, ii, p. 933). Irvine (*Materia Medica of Patná*, 1848, p. 48) mentions the use of the flowers as a dye. Its use as a dye plant is again mentioned by the author of *Report on the Land Revenue Settlement of the Hoshangabad District*, 1865, p. 180, but the part of the plant used is not named. Sir Edward Buck is the next explicit writer: in his *Dyes and Tans of the North Western Provinces*, 1875, p. 25, he describes how the fallen flowers are collected in the morning from the ground under the bushes, dried, boiled in water when the dye is wanted and the cloth stained in the infusion becoming buff or orange.

Balfour (*Cyclopædia of India*, third ed., 1885, ii, p. 1116) speaking of the plant's occurrence under the Vindhyas, says the bark is used for tanning, the flowers for dyeing silk yellow. It is used in Surat.

Thwaites (*Enumeratio Plantarum Zeylaniæ*, 1864) says priests' robes are dyed with **Nyctanthes** in Ceylon.

The flowers teste Liotard (*Memorandum on Dyes of Indian Growth*, 1881, p. 59) were sold in the largest bazaars of the United Provinces at prices ranging from Rs. 10 to Rs. 60 (13*s.* 4*d.* to 80*s.*) per maund (82 $\frac{2}{7}$ lb.), and he quotes Baden Powell as authority for its sale in Delhi, Gurgáon, Ambálá and other places in the Punjáb. The writer of the *Gazetteer of the North-Western Provinces and Oudh*, x, Himálaya districts, said that it was much used, and the price of its flowers 2—6 seers (4·12 to 12·36 lb.) per rupee (1*s.* 4*d.*) *i.e.*, *about* Rs. 6$\frac{1}{2}$—Rs. 20 (8*s.* 8*d.*—26*s.* 8*d.*) per maund (82$\frac{2}{7}$ lb.).

M'Cann (*Dyes and Tans of Bengal*, 1883, p. 42) records its general sale in Bengal at prices ranging from 3 annas to 28 annas (3*d.* to 2*s.* 4*d.*) per seer (2·06 lb.), *i.e.*, Rs. 7$\frac{1}{2}$ to Rs. 70 (10*s.* to 93*s.* 4*d.*) per maund (82$\frac{2}{7}$ lb.).

While Sir Edward Buck says that the preparation of the dye is made by boiling 10 gallons of water containing 12 seers (24·72 lb.) of flowers down to 1 gallon, M'Cann says that in Bengal the boiling down is not carried so far, 9 gallons being boiled down to 3 or 6. M'Cann adds that the proportion of flower-tubes to water varies enormously from 1 seer to 1$\frac{1}{2}$ ($\frac{9}{160}$ths to $\frac{3}{160}$ths gal.) of water (Dinájpur) to 1 seer to 40 seers ($\frac{2}{160}$ths to 8 gal.) of water (Húghlí) and he adds that there is probably no fixed rule.

The writer of the Kánara volume of the *Bombay Gazetteer*, xv, 1883, p. 437) says that the flowers are used for dyeing. Nagendra Náth Banerjee (*Report on the Agriculture of the District of Cuttack*, 1893, p. 199) writes briefly of the drying of the corolla-tubes for dyeing and so also does A. F. Cox, (*Manual of North Arcot District*, revised by H. A. Stuart, i, 1895, p. 31).

Duncan (*Monograph on Dyes and Dyeing in Assam*, 1896, p. 37) states that the dye is used in Sylhet and Darrang: what he says is worth quoting in full. In Sylhet the process of dyeing with the plants is as follows: "Take half a seer (1·03 lb.) of the corolla-tubes of the flowers and boil them in 5 seers (1 gal.) of water till the volume is reduced to about 4 seers ($\frac{4}{5}$ths gal.)." Note this is less than other boilings given above. "Then put in 1 chittak (2·057 oz.) of nitric acid. The result is a permanent orange colour. If only half a chittak of nitric acid be used, the result is a much lighter

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orange. If the orange thus obtained is really a fast colour, the above process is interesting, because hitherto no means of rendering the colour fast has been discovered or rather published. The plant is known in the Assam valley, but its use appears to be confined to the Darrang district, and even there it is reported to be becoming rare. It is used in Darrang occasionally to dye silk thread. The corolla-tubes are kept in water—it is not stated whether the water is hot or cold—for six hours when the water becomes quite yellow. The thread is then put into the water, and kept there six hours, and is then taken out and dried; when dry it is a deep yellow. This account is remarkable inasmuch as boiling does not enter into the process at all: no mordant is used, and I presume the colour obtained is not a fast one."

Next Russell (*Monograph on Dyeing Industry of the Central Provinces* for 1896, p. 15) mentions the dyeing as practised there.

Mention has been made of the statement by Buchanan-Hamilton that the inner bark was in his time used to give a yellow dye. Dymock (*Vegetable Materia Medica of Western India*, 2nd edition, 1885, p. 474) says that the leaves stain the saliva yellow if chewed. It has not been shown if it is the same dyeing substance which is in the bark, leaves, and flowers; but it is probable that it is the same substance.

Sir Thomas Wardle examined the dyeing properties of the flowers and reported on them.

Saffron—Crocus sativus.

Saffron is too expensive to be used as an ordinary dye. The fairly large quantities which India consumes are used up in religious observances, in medicine and for colouring food: rarely, and only on great occasions, as for instance in marriages among the richest, are clothes dyed with it—and in that the use is again religious. The use in Bengal is recorded by Nagendra Náth Banerjee (*Monograph on Dyes and Dyeing in Bengal*, 1896, p. 30); but of its use as a dye for clothes, no explicit mention is made by those who have written upon dyeing in other provinces except that Liotard (*Memorandum on Dyes of Indian Growth*, 1881, p. 94) describes the process of dyeing. It is used in Kashmir and Upper India for caste marks.

INCOMPLETENESS OF PRESENT INFORMATION.

In the preceding paragraphs (pp. 7—23) I have given, in outline, what we know at present regarding the uses in India of these flower-dyes. If we are to know more, the information should be collected at once, lest their uses go out before we seek it. The flower-dyes are apparently far more used in Upper India than in Southern India, but in regard to Madras our information is more meagre than in regard to the Punjab and the United Provinces.

FLOWER DYES MORE USED IN THE NORTH THAN IN THE SOUTH.

This has been due to the many excellent men who have devoted their time to investigations on industries in Northern India—men like Baden Powell of the Civil Service, Lindsay Stewart, a Forest Officer, Aitchison of the Indian Medical Service, and others still alive; whereas Southern India has had few men who have found such interests.

According to our present information cotton flowers are only used as a dye in the Punjáb, Mainpuri, near the Punjáb border, and Sind.

Marigold flowers are only used along the borders of the Ganges valley from the Punjáb to Lohárdagá in Bengal.

The use of **Delphinium Zalil** is wider: it extends through the Punjáb and Sind into the United Provinces and some unknown distance down the Presidency of Bombay. The use of **Cedrela Toona** flowers is a little wider still: they are employed in the Punjáb, the United Provinces, parts of Bengal and in parts of the Bombay Presidency, appearing southwards in Kánara and also in adjacent Mysore and Coorg.

Woodfordia flowers are used over Northern India and as far South as the Nizám's dominions: possibly they are also used in some parts of Madras and perhaps also in Burma.

Nyctanthes flowers are known to have been fairly generally used in Northern India, though apparently not in the Brahmaputra valley. Southwards their use extends at any rate interruptedly to Ceylon.

To **Butea** and **Carthamus** may be ascribed a general use over all India.

Quite local and peculiar is the use of **Impatiens Balsamina** among the Chins and possibly some tribes of Assam, of **Hibiscus Sabdariffa** among the Shans and people of Chutiá Nágpur, and of **Erythrina** at Húghli in Bengal.

ANILINE COMPETITION.

Aniline dyes, which are now imported into India in considerable quantities with a view to displace the indigenous dyes, may be sold under the names that belong in one or other of the vernaculars to the natural dye. Thus for instance we find among these Aniline dyes boxes labelled 'Kesari pucca', *i.e.*, genuine saffron. However as regards the flower-dyes this is the only instance that I can quote.

COLOURS GIVEN BY FLOWERS THAT DYE

I now propose to pass on to a consideration of the colours that these flower-dyes give. They are all yellow, orange, yellowish, brown, drab or rose-red: but some of the yellows are very beautiful colours. The following table is compiled from Sir Thomas Wardle's report:—

	Silk.	Bleached tusser.	Unbleached tusser.	Wool.	Bleached cotton.	Unbleached cotton.
Delphinium Zalil. Asbarg.	bright and also light yellow.	yellow. brownish yellow.	dull yellow. brownish yellow.	greenish yellow.	.....	.....
Cotton flowers (Gossypium).	bright yellow. greenish yellow. bright brownish yellow. reddish yellow.	brownish yellow. reddish yellow. drab.	brownish yellow. fawn. reddish yellow. drab.	bright orange. reddish yellow.	faint yellow.	light yellow.
Thespesia	light reddish yellow. light brownish yellow. light greenish yellow.	light yellow. light reddish yellow. dull greenish yellow. light grey.	light brown yellow. light yellowish drab.	reddish yellow. yellowish grey.	.....	.....
Tún flowers **Cedrela Toona**	bright yellow. brownish green.	brownish yellow.	brownish yellow.	light yellow. brownish yellow. greenish yellow.	yellow.	yellow.
Dhák flowers **Butea frondosa**	light yellow. bright yellow. fawn. brownish yellow. yellowish grey. grey-drab.	yellow. brownish yellow. yellow grey. drab.	yellow. brownish yellow. brown orange. fawn. yellow drab. drab.	bright yellow. bright orange. brown orange. greyish yellow. drab.	brownish yellow. greyish yellow. reddish drab. fawn. drab.	.....
Carthamus Safflower yellow.	brown-yellow.	brown yellow.	brown yellow.	.....	yellowish grey.	light brown yellow.
Carthamus Safflower-red.	deep red. deep crimson.	deep red. yellowish red.	deep red. brown red.	yellowish red. scarlet.	bright pink. bluish pink.	bluish pink.
Marigold flowers **Tagetes.**	yellowish grey.	light brownish yellow.	brownish yellow. drab.	deep brownish yellow.	.....	.....
Woodfordia	light reddish grey. brownish grey. brownish yellow. greenish drab.	yellowish grey. yellowish brown. light brownish yellow. greenish drab.	brownish yellow. yellowish brown. brown. brownish grey. reddish slate. deep slate.	brownish yellow. brownish grey.	light slate.	slightly grey.
Harsinghár **Nyctanthes.**	light yellow. bright yellow.	bright yellow.	light yellow. bright yellow.	bright yellow. dull yellow.	.....	.....

PERMANENCE. Fading of dye.

After writing his report Sir Thomas Wardle sent out to India in 1886 the samples of cotton, silk and wool that he had dyed with the various Indian dyes; and they were deposited in the Bengal Economic Museum. These examples are now in the Indian Museum, and I have examined them all, comparing the present colours with Sir Thomas Wardle's descriptions. Most of the specimens have not been exposed to light but have been kept in large folios just as received; though others, since 1899 or 1900, have been exhibited in the diffused but good light of the Economic Gallery of the Indian Museum. I shall now make some remarks upon these specimens. Out of the long series which has not been exposed to light, tissues of corah silk, tusser, wool and cotton, dyed with **Nyctanthes** and Tún flowers have faded much, often completely so. So much more have they faded than the others that we must set them down as distinctly inferior. Cotton flower-dye has also faded or changed on all these tissues. I do not understand the changes. One sample of which is described as being orange in 1886 is now ochre—a darkening,—one sample of wool described as being reddish-yellow in 1886 is greenish-yellow now, and a sample of corah silk which was reddish-yellow in 1886 is pale-yellow now.

Changes in other dyes are not generally detectable, but some deadening of the brilliance is to be expected in almost all. However a sample of corah silk dyed with **Delphinium Zalil** by one of Sir Thomas Wardle's processes is still of brightness hardly to be excelled.

The samples which have been exposed to light are from three dyes only: **Butea,** Safflower and **Woodfordia.**

Butea shows more signs of fading on cotton than on other tissues: it shows some sign of fading on corah silk and tusser but not much: on wool in a pale shade it shows the same sign of fading, but not in a rich orange.

The duller colours of **Woodfordia** are perhaps a little faster to light: very few of the specimens in the Indian Museum show distinctly that they have faded.

The colours of safflower have all faded more or less, whether of safflower yellow or of safflower pink: safflower yellow on cotton has faded completely, and almost completely on silk. This dye is of course known to be fugitive. Safflower red has nowhere faded completely, but has faded very greatly on every fabric whether silk, cotton or tusser. There are no samples of it on wool.

This is all that I have to say about Sir Thomas Wardle's specimens. I have next to mention the colours which Hummel and Perkin obtained.

PERMANENCE.

Hummel and Perkin (*Journ. Soc. Chem. Industry*, xiv, 1895, p. 459) tried the flowers of **Butea** and after showing that the colouring matter is not actually existing in the natural state, but is produced by the heat in the boiling of them by way of preparation, they add that "**Butea** flowers" after a boiling with a dilute mineral acid and subsequent neutralising with Sodium carbonate "give with the different mordants on wool colours which somewhat resemble those obtained from young fustic, namely a terra-cotta shade with chromium, a bright orange shade with aluminium, bright yellow with tin, and a brownish olive with iron. The chromium colour is remarkable by being much redder in hue than the corresponding colour obtained from all other yellow mordant dye stuffs." All the colours on wool were found to be very fugitive to light. The authors therefore added that they could not endorse Sir Thomas Wardle's opinion that **Butea** flowers if cheap enough would be a useful addition to the generally used yellow dyes.

I now pass on to Prof. E. R. Watson's work which is embodied in two papers on "The exact determination of the fastness of the more common indigenous Dyes of Bengal" (*Memoirs Asiatic Society of Bengal*, ii, No. 3, 1907, pp. 25-41, and No. 7, 1908, pp. 155-168). Professor Watson compares safflower red and **Butea** dye with aniline colours by dyeing on cotton and on Mulberry silk. He exposed his dyed tissues to light, soaped them, tried them with acids and also with alkalies.

The results of his experiments with cotton were not encouraging, but with silk he considers **Butea** dye much better.

It is first to be remarked that while Sir Thomas Wardle used the best (and secret) European processes known to him, Professor Watson used the indigenous methods of dyeing—so that while the results of the one indicated the possible, the results of the other indicate the easily attainable.

As a result of his work Professor Watson classed Butea-dye on cotton, both without a mordant and with alum, in his first or least-fast class as regards light, soaping, alkali and acid; and safflower was only better in regard to acid, attaining the third or fourth of his four classes.

The Aniline dyes used for comparison were everyone of them as good or better in every respect except that safflower as regards acid stood above two.

In dealing with silk Professor Watson found safflower much as it was in regard to cotton; but Butea-dye reached the third class in permanence to light both without a mordant and with alum: in

regard to soap if mordanted with alum it reached the third class though it was poor if not mordanted: if not mordanted it was in the second class as regards alkali and in the fourth or firmest as regards acid: when mordanted with alum as regards alkali it was found to be between the second and the third class, and as regards acid in the second class. In these respects it was found to be better than half of the aniline dyes used. PERMANENCE.

In days past the plain of Palási (Plassey) was covered with **Butea,** the Palas trees; hence its name; and Murshedabad probably got therefrom a very good dye for its silks.

Nyctanthes is the remaining flower dye tried by Watson: but he tried it on silk only. With or without a mordant it fell into the second class as regards light, between the second and third as regards soaping and alkali, and into the third as regards acid.

Report on the colouring matters of the flowers of Thespesia Lampas.

By Mr. A. G. Perkin, F.R.S.

The sample consisted of yellow flowers closely resembling those of the cotton plant **(Gossypium herbaceum).** To isolate the colouring matter these were extracted with alcohol, the solution evaporated, treated with water and agitated with ether to remove wax. The aqueous liquid contained a glucoside, but owing to the small amount present, and its soluble nature this has not up to the present been isolated. On digesting its solution with a little hydrochloric acid it is readily hydrolysed with separation of the yellow colouring matter, which was collected, dissolved in a little alcohol, the liquid poured into ether, causing the precipitation of certain impurities. These were removed, the ethereal liquid evaporated to dryness and the yellow residue acetylated, and the acetyl compound after purification hydrolysed in the usual manner. REPORT ON THESPESIA LAMPAS.

It consisted of yellow needles which, on analysis, gave numbers according with the formula $C_{15}H_{10}O_7$, and its acetyl compound $C_{15}H_5O_7$ $(C_2H_4O_5)$, also analysed, melted at 189°—190°. These results indicated that this colouring matter was Quercetin, and dyeing and other experiments confirmed this view.

Two hundred and fifty grams of the flowers gave approximately 1·5 grams of quercetin or 0·5 per cent., but as many of the petals were discoloured in the sample here examined, it is likely that in the fresh condition a larger quantity of this colouring matter is present.

REPORT ON THESPESIA LAMPAS.

Dyeing experiments were carried out with this material employing woollen cloth mordanted with chromium, aluminium, tin and iron. The results (patterns enclosed) are fairly good.

As a dyestuff these flowers might perhaps be employed advantageously in the districts in which they abound, but I fear could not compete in this market with better known yellow dyewares.

Report on the colouring matter of the flowers of Hibiscus Sabdariffa.

By Mr. A. G. Perkin, F.R.S.

REPORT ON HIBISCUS SABDARIFFA.

These flowers were treated by a similar method to that employed for those of **Thespesia Lampas,** and were found to contain yellow colouring matter. The yield was poor, 500 grams of the material giving but 1·8 grams of the crude substance.

This product consists of at least two colouring matters; (A) Glistening yellow needles, m.p. about 340—341°C., very sparingly soluble in alcohol, and (B) Yellow needles, m.p. about 295°C., readily soluble in alcohol. The small quantity of the mixed substances which it is possible to obtain, and the loss occasioned during their separation render their accurate examination extremely difficult.

A, I have reason to believe, is an interesting new colouring matter of the flavone group, whereas B, somewhat closely resembles the Gossypetin previously isolated from the flowers of the cotton plant. For instance on acotylation an acetyl derivative, m.p. 224°—226°C., has been obtained from it, which gives numbers similar to those required by acetyl gossypetin, and again the other properties of the two substances are very similar.

I hope to be able to speak more definitely on these points at a later date.

Dyeing experiments with the flowers have been carried out employing mordanted wool and the patterns are enclosed.

The shades are somewhat similar to those given by the **Thespesia Lampas** flowers, but are poorer in character and should the sample of the flowers examined represent the average quality of the material, it can hardly be recommended as a dyestuff for even purely local purposes.

The aqueous extract of the plant possesses a somewhat red tinge, and it was noted that the effect was due to the presence of a small quantity of red sepals. When freshly gathered these, no doubt, would be more numerous, though as the red matter does not dye with mordants and has little effeit upon fabrics, it cannot be regarded as a dyestuff in the true sense.

Postscript.

NYCTANTHES.

Since the above was written a paper by E. G. Hill and Annoda Prasad Sircar on **Nyctanthes** has fallen into my hands. It is entitled "A new colouring matter from **Nyctanthes Arbor-tristis**" and is printed in the *Journal of the Chemical Society*, dxxxix, pp. 1501-1505. The authors describe the dye under the name of Nyctanthin but have not yet proceeded so far with their work that the chemical relationship of the dye to other flower dyes can be stated.

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PWÊ-NYET.

(BLACK WAX OF BURMA).

Pwe-nyet and Indian Dammars, by DAVID HOOPER, F.C.S.

INTRODUCTION.

The peculiar resinous substance known in Burma as *Pwê-nyet*, *Poon-yet*, or *Pwai-nget* was first brought to public notice in 1857. In April of that year Sir Archibald Bogle, Commissioner of the Tenasserim Provinces, forwarded to the Agri-Horticultural Society of India a specimen of this substance procurable at a low cost in those provinces. He informed the Society that he had found it to be a very valuable cement; on softening the material with a little earth oil to the consistence of paint and spread on pieces of cloth and applied to cracks in the roof, it made them quite waterproof. Its properties would render it worthy of further investigation.

Mr. Parish's description.

Rev. C. S. Parish, Chaplain of Maulmain and a member of the Agri-Horticultural Society, was invited by the Secretary to furnish further information as to the nature of the material in question. Mr. Parish's reply, supplemented by the information contained in his letter addressed to the editor of "Science Gossip," in 1866 affords the most exact description of Pwê-nyet that has appeared in any more recent literature.

Pwe-nyet prepared by a bee.

Mr. Parish discovered that it was not a natural resin but the result of the labours of a small bee. He believed Pwê-nyet to be a combination of various gums or resins, probably also of oils, gathered from various sources while in a soft state by the bee and built up and moulded as wax, with this difference, that whereas wax is formed by the honey bee into cells of uniform symmetry, the cells of Pwê-nyet assume no regular form at all. He considered that the resin of the Thingan tree (**Hopea odorata**) formed the chief ingredient while the oleo-resin of the Dipterocarps or wood-oil tree also entered into the composition of the material. The reason

for this assumption was that **Hopea odorata** and **Dipterocarpus lævis** were the principal giant trees of the forests of Tenasserim.

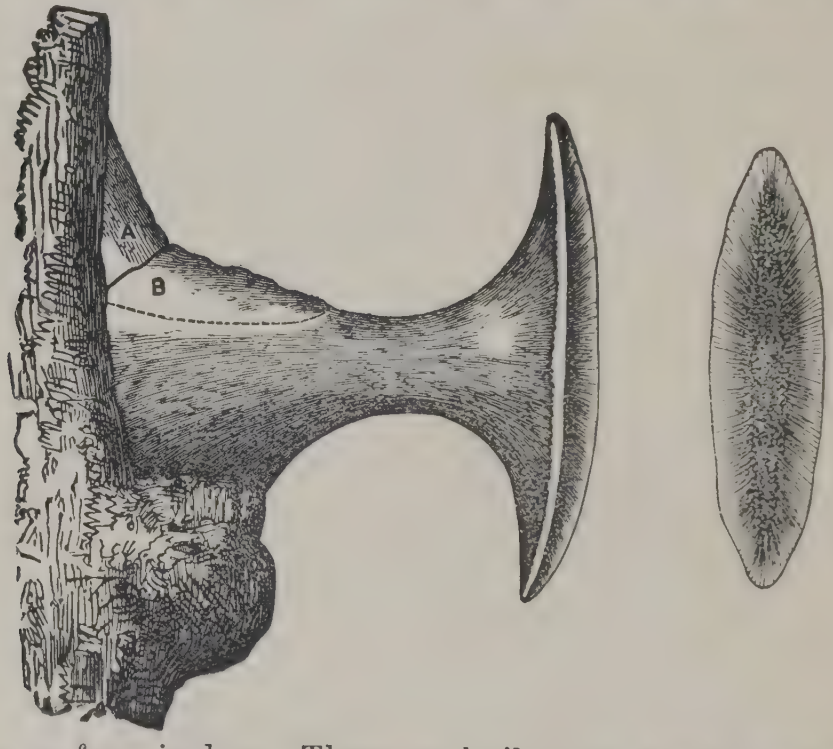
THE NEST OR HIVE.

Mr. Parish then proceeds to describe the nest of the bee, the interesting account and illustration of which are taken from Dr. M. C. Cooke's "Report on the Gums, Resins and Resinous Products of the Indian Museum" (1874).

"The **Trigona læviceps** builds its nest generally in the hollow of a tree, entering by a small aperture. These apertures are lined with Pwê-nyet, and sometimes only show a small rim of that substance raised above the bark of the tree. Sometimes, however,

Description.

the bees go on building outside and adding on to the rim until they have formed a wide-mouthed entrance which projects as much as a foot from the tree. These structures commonly assume the shape of the mouth of a large trumpet flattened horizontally, and have a perpendicular diameter of a foot or so, and a horizontal diameter



of three or four inches. They are built with great regularity in their exterior half, but not so regularly towards the base, from the necessity of adapting the structure to the shape of the tree where the hole may chance to be. They are very curious and pretty objects, but being very prominent, attract the notice of the passers-by, and so often lead to the spoiling of the habitation. I send a rude sketch of one of these trumpet openings. The drawing, one-sixth the natural size, is an imaginary restoration. The portion marked A forms the specimen herewith forwarded, showing the ordinary texture, colour and general appearance of Pwê-nyet as it

is found in the jungles. B within the dotted line marks the space over which the blind cells, presumably for strength, extend. From the shape of the base the mass must have rested partly on some such excrescence of the trunk as is represented. The actual entrance into the tree in this instance was by a very narrow perpendicular slit two and a half inches long and three-tenths of an inch wide, the upper part of which may be seen in Fig. 2. The width laterally in the middle of the stem of the structure is exactly one and a half inch. The weight of the whole is probably half a pound. What the internal economy of the nest is I cannot say, as the tree has commonly to be felled in order to obtain the contents. I am informed by the Burmese that from five to ten viss (18·25 to 36·5 lbs.) are usually obtained from one nest."

THE NEST OR HIVE.

Yield of one nest.

A more recent account of the formation of the nests yielding Pwê-nyet was contributed to "Capital," September 1907, by A. M. S[awyer], an experienced resident in Burma.

"In the evergreen forests of South Tenasserim the Kanyin (**Dipterocarpus turbinatus**) is tapped for its oleoresin. The method employed consists of the excavation, by means of narrow long-bladed adzes, near the foot of the tree or a little above it of deep hollow cavities extending into the wood of the trunk for a foot or more. To stimulate the flow of resin into these cavities, their bases, roofs and sides are fired. When the resin by this means accumulated in the cavities will have been ladled out and collected, their charred and resin-clogged edges and surfaces, after being re-cut, are burnt again. These operations are regularly conducted at suitable intervals throughout the tapping season, at the close of which the tree is left to recuperate for a period of years. In course of time the gaping cavities are covered over by the growth of new wood, but not before the irritation caused by the festering wounds will have long since led to the formation of spacious hollows in the trunk when as it often happens the approximation of the edges of the callosity is so complete as to leave spaces between them, insects such as ants and bees find admittance to the hollows beyond. Thus it is that closed hollows offer some of the most ideal natural conditions for the installation of hives of sorts. The hollows that form in the stems and branches through natural decay consequent on age or as the result of irritation or injury also afford shelter to bees.

Description in "Capital."

"The presence of the hives of pwê-nyet bees is revealed by the truncate-conical or cylindrical resin tubes constructed around their

Tubes of resin.

THE NEST OR HIVE.

narrow entrances. These tubes are constructed of pellicles of nearly transparent resin combined with minute grains of masticated wood and bark, sand, clay and the like. The lower and older portions of the tubes are brittle and admit of its being easily detached, while their upper ends are soft and sticky. When they are broken or removed the tubes are speedily mended or re-constructed, so that the hives, if ever, are seldom without them for any length of time. The hives themselves, placed well in the interior of the hollows, are constructed of dense masses of pwê-nyet. The cells that vary from one to two inches in length and one and a half inches in diameter each, are ovoid-oblong flattened structures which, though smooth-walled within, lack the regular shape, order or precise arrangement so much admired in those of the common honey bees. They are out of all proportion to the size of the insect, the young of which swarm on the inner sides of the drier cells. Varying with

THE HONEY.

their age the cells contain honey of varying flavour and strength, the sweetest liquor is held in the newest and the most astringent and bitter in the oldest cells."

The Insects.

THE INSECTS.

Specimens of the insects forming Pwê-nyet near Maulmain were sent by Mr. Parish to Calcutta in 1857, and at the suggestion of Mr. W. S. Atkinson, Secretary of the Asiatic Society, they were forwarded to Mr. F. Smith of the British Museum for identification. Mr. Smith identified them as **Trigona læviceps,** originally

Identification.

described from Singapore. Mr. Smith's description* is as follows:—**Trigona læviceps.** Worker, $1\frac{1}{2}$ line. Head and thorax black: the face, above the insertion of the antennæ, smooth and shining; the antennæ rufo-testaceous; the clyperus with a hoary pubescence; its anterior margin, and also the mandibles, ferruginous, thorax smooth and shining, the meta-thorax highly polished, the wings subhyaline and iridescent, the stigma and nervures ferruginous. Abdomen ferruginous, smooth and shining. Habitat, Singapore.

Reference in Fauna of British India.

In Blandford's Fauna of British India (Hymenoptera), Vol. I (1897), 561, by Lieutenant-Colonel C. T. Bingham, **Trigona læviceps,** Smith, is referred to under the synonym **Melipona læviceps,** Dall., and is said to be a common species building its nest often in crevices in the brickwork of the walls of houses. The dammar-bees, as the species of this genus are sometimes called, are

* Catalogue of the Hymenopterous insects collected at Sarawak, Borneo; Mount Ophir, Malacca, and at Singapore. By Frederick Smith, Assistant in the Zoological Department in the British Museum. *Journal of the Proceedings of the Linnean Society (Zoology)*, Vol. ii (1858), 42—130.

THE INSECTS.

widely spread, being plentiful in South America and in the Oriental region. All build their nests in hollows of trees, crevices among rocks and sometimes in holes of stone walls. The species of this genus and also of its ally, **Melipona**, are destitute of stings.

Melipona læviceps is not the only dammar-bee that manufactures this peculiar resin in Burma. "A.M.S.," a portion of whose article has already been quoted, says: "Besides the commoner species of Apis which construct hives yielding honey and wax, there are at least four distinct stingless species of the same or of closely allied genera that engage in the comparatively laborious production of pwê-nyet as well as in the secretion of more or less honey. These are found in both In and Kanyin forests and are known in Burmese as (1) *Toung-zon-byu*, (2) *Anet*, (3) *Wa-pan-ma* and (4) *Myit-hmwe-lain*....(1) is a black, robust insect, one-third of an inch in length, the lower halves of the wings of which are white and glistening; it builds small hives of brown pwê-nyet of good quality. (2) is a black insect which builds the larger size hives with yellow pwê-nyet of the best quality; economically this product is the most valuable. (3) is a yellow bee constructing large hives like (2), the pwê-nyet itself resembling that of (1). (4) is a small yellowish-brown bee building a small hive of black sticky pwê-nyet of inferior quality. In the hives of these insects, it will be seen that pwê-nyet takes the place of wax, probably because either the insects, unlike the common honey bees, are not endowed with the capacity of excreting, or because the quantity of it excreted is insufficient for the purpose of hive construction, or again because its quality is such as to preclude the possibility of its application thereto."

Four kinds of bees.

The resin hive.

These small stingless and dammar bees are also known in other parts of India, and certain of them with the analyses of their wax are referred to in *Agricultural Ledger* No. 7 of 1904 entitled "An Account of the Sources, Preparation, Trade and Composition of the Bees'-wax of British India." These insects are known under the following vernacular names:—*Kunti, kote, poye, nasari, pove*, Bomb.; *Bhinkwa, bhumkua, bhungaira*, United Prov.; *Bankura*, Pb.; *Misri, misri-jiga, misri-jen, sollejenuhula*, Kan.; *Kota, kuntali, lokhra*, Central Prov.; *Nasri theni, kosutteni*, Tam.; *Musuru-teniga, musari egalu*, Tel.; *Moye byah*, Burm.

The wax is regarded of poor quality and is only used locally. In the Central Provinces the wax of the Kota bee * is sold at the

Description of wax and honey.

* Probably **Melipona cacciæ** (see Major C. G. Nurse, A new species of wax-producing bee. *Journ. Bomb. Nat.-Hist. Soc.*, xvii, 1907, p. 619).

INDIAN DAMMAR BEES.

low rate of two to four annas (*2d.* to *4d.*) a seer (about 2 lb.), because it is darker in colour and more sticky than ordinary yellow bees'-wax. The honey of these bees is often tainted with a peculiar odour and bitterish and acid taste, and has a considerable reputation in many parts for its medicinal properties. In Nellore the honey is regarded as intoxicating.

A species of dammar bee, **Trigona ruficornis,** Smith, is thus described by Mr. Horne in the *Journal, Zoological Society,* Vol. VII, 185:—

Trigona ruficornis.

"This is one of the smallest honey-bees I have ever met with, and its habits are curious. I noticed it under the following circumstances, and I never again met with its nest, although the natives all know it. One evening, at Benares (April 4, 1863), as

Benares.

I was standing at my door I saw a swarm of from 400 to 500 of what I took to be midges rapidly flying about in a mazy kind of dance, occupying a space of five or six feet, and being about ten feet from the ground. I brought out my insect-net and caught about a hundred in one sweep, when, to my surprise, they proved to be bees. On watching them I observed that they went in and out of a little hole in the wall close by, under a beam where was a hollow, and that many of their thighs were laden with pollen.

Habit of insect.

"The insects seemed quite harmless, walking about my hand and not attempting to sting. Digging out some bricks with care, I came on a portion of their nest. The space it occupied appeared to have been originally eaten out by Termites. It was coated on all sides with a layer of black wax, and in it was stored their honey. The waxen cells were of a dark brown colour and very globular, pendent side by side from the roof, and not, as far as I could see, arranged hexagonally.

"The honey was very dark in colour, but excellent in flavour, and I was told by the natives that it possessed medicinal qualities. It had a slight astringency and, considering the size of the insect, the quantity stored was very large. I was also told that these insects commonly use hollow trees, in which they store astonishing quantities of honey, which is diligently sought for and highly prized. They called them "Bhonga," which appears to me to be a generic name for all bees in the North-West Provinces. Large bricks prevented my digging further, so that I cannot describe their breeding cells."

Malabar.

Major-General H. R. Morgan in *Forestry in South India* (124) refers to the occurrence of these insects in Malabar. "**Trigona**—a very minute bee which builds in the crevices of walls,

THE INSECTS.

etc. The globular cells are built of a mixture of various substances which I have seen these little creatures collecting from **Mesua, Calophyllum, Canarium, Artocarpus,** and other trees. It resembles cobblers' wax in appearance. The amount obtained from each hive is very small, about half a pound or so."

Straits Settlements.

These bees are also known in the Malay Peninsula. In the *Agricultural Bulletin of the Straits Settlements* (Vol. VII, No. 2, February 1908, 40) a description is given of a varnish obtained by the Malays from a jungle tree, **Garcinia merguensis,** Wight. "Notches are made in the bark at 5 p.m., and the gum-resin is collected early next morning before the little bees, known as Keluent (**Trigona**), can come to secure the resin and build their nests."

Trinidad.

In Trinidad species of **Trigona** were observed to carry off the rubber fluid from the stems of **Castilloa elastica,** and the gum-resinous exudation of the **Garcinias,** as a sort of ready-made wax for their nests. In some cases they actually cut the bark to cause a flow of the desired fluids.

It is hoped that a determination of the various species of **Trigona** and **Melipona** in India will in due time be made; and it will be interesting to observe what special resinous secretions are preferred by each species of the insect.

Trade.

Trade in 1867.

In the returns of exports from the port of Rangoon for 1867 it is shown that 1,000 viss (=3,650 lbs.) of poungit, dammar or tamah were sent to Maulmain, Akyab, Tavoy and Mergui.

For the year 1866-67 the following quantities were exported from Maulmain:—

	Cwt.	Rs.
Rangoon	$16\frac{1}{4}$	75
Tavoy	68	303
Mergui	$9\frac{3}{4}$	45

Exports.

In addition to the exports from Maulmain poungit or dammar was imported from Rangoon and Penang, but as the article from Penang was one-quarter of the price of that from Rangoon, it is to be inferred that the Straits dammar resin and not pwê-nyet was indicated. Mr. Parish pointed out that mistakes of this nature were often made owing to the fact that the name dommar or dammar was given to Burmese pwê-nyet in the bazar by the natives of India.

USES. The right of collecting pwê-nyet is sold annually by the local Government in Tenasserim and other parts of Burma, and this forms one of the sources of revenue under Minor Forest Products.

A minor forest product. In the Burma Forest Report for 1899-1900, 10,530 viss (343·16 cwt.) of dammar were collected from the unclassed forests of the Tenasserim Circle and realised Rs. 1,985 (£132 6*s*. 8*d*.). In 1900-1901, 11,824 viss (385·33 cwt.) were removed and valued at Rs. 2,073 (£138 4*s*.). In 1906-07 the value of the dammar rose to Rs. 4,200 (£280). If this product may be taken as pwê-nyet, the price is 3 annas (3*d*.) per viss (3·65 lbs.) or Rs. 5-8-0 (7*s*. 4*d*.) per cwt. The selling price in Rangoon is four to eight annas (4*d*. to 8*d*.) per viss.

Uses.

USES. The principal use of pwê-nyet in Burma is for caulking boats. For this purpose it is mixed with earth oil or petroleum. The method is to boil the material in water which makes it quite soft,

Caulking boats. and then to knead it with a certain quantity of petroleum until it attains the consistency of a lump of putty which it much resembles. In that state it is very viscid and tenacious and is ready for use. It may be seen in all the boat-builders yards in Pegu for luting the

Waterproof material. joints of new boats and repairing old ones. It may also be applied to cracks in the roofs of houses to render them waterproof in the rains, and to wooden floors and boxes. The mixture of pwê-nyet and earth oil is used for painting over Burmese umbrellas.

Cement. In South India black wax is used for water-proofing the powder-pan of matchlocks, and for fixing the mouth-pieces of Indian bagpipes made with two reeds and a gourd.

Resembles shellac. If better known it might be used more extensively in the arts and industries of the country. The superior grades are light in colour and would be suitable for white varnishes and polishes. Old and dry samples resemble shellac and could be utilised for sealing wax and cement.

Examination of samples.

EXAMINATION. Pwê-nyet as sold in the bazar is commonly in irregularly shaped lumps, tough and plastic in the hands, and readily softening when warmed. According to its quality it is black and dirty, brown, or light coloured like yellow wax. Fresh samples have a faint aromatic

Description of samples. odour. On exposure it becomes hard dry and brittle, and loses its aroma. The specific gravity is 1035.

EXAMINATION.

The following samples in the Indian Museum were examined:—

1. No. 16962. Pwê-nyet from In tree (**Dipterocarpus tuberculatus**). Brown solid and brittle resin, consisting of the trumpet-shaped openings of the nest. From Pokokko.
2. No. 22888. Pwê-nyet from Amherst District. Black resinous mass, tough in consistence.
3. No. 28441. Inferior quality from Maulmain. Blackish-brown tough mass with visible impurities.
4. No. 28442. Superior quality from Maulmain. Light yellow mass enveloped in leaves.

The following constants were obtained:—

	1	2	3	4
Moisture	2·8	5·6	3·5	3·2
Ash	1·0	7·3	14·8	·3
Soluble in alcohol	65·0	72·0	69·3	86·2
„ „ ether	81·1	61·9	60·1	72·2
„ „ petr. ether	41·9	65·5	58·8	70·3
Acid value	32·2	26·2	30·8	28·3
Ester value	56·3	24·1	24·2	23·9
Saponification value	88·5	50·3	55·0	52·2
Iodine value	52·0	105·3	104·7	137·1

The samples agree in being only partially soluble in the usual volatile liquids and in possessing a low acid value. The wax of the true pwê-nyet samples melted between 70° and 80°. The portion dissolved by alcohol was an amber coloured resin melting between 90° and 100°, the portion insoluble in alcohol and other volatile liquids was a white brittle resinous substance melting between 190° and 200°. The solid resin forming the opening of the nest gave a soluble brown resin melting at 130° and an insoluble white resin melting at 180°. Whether this resin is merely pwê-nyet dried by exposure or a substance of different origin can only be determined by comparing its properties with those other samples of resin of known botanical source. The disappearance of aroma in the hard resin, and its low iodine value compared with that of soft pwê-nyet indicate a loss of volatile oil either through evaporation or oxidation. That pwê-nyet in the fresh state does contain an oil may easily be seen by warming a small quantity in water when a film of oil appears on the surface.

Resins

Loss of oil.

The solubility and chemical constants of pwê-nyet might be the means of explaining its origin, since as far as our information goes

Origin of resin.

EXAMINATION. the resin is obtained from various trees. Dr. McClelland remarked that it was yielded by the **Shorea robusta** or Saul tree of India. This mistake was afterwards corrected and it was supposed to be the "pure unadulterated gum or resin of **Canarium strictum,** only bored and channeled by the bee." Mr. Parish, as recorded above, was inclined to the opinion that pwê-nyet consisted of the resin of **Hopea odorata** mixed with the oil of various dipterocarps or wood oil trees, particularly of **Dipterocarpus lævis**. The dried resinous openings of the nest have been sent to the Indian Museum as the resin of **D. tuberculatus,** from the fact of the nest being attached to that tree. The chemical nature of Burmese black wax has apparently never been examined nor indeed are there any published analytical constants of those resins known as dammars whose botanical origin has been determined. It seems, therefore, necessary in the first place to define the distribution of the Indian dammar trees and then give some comparative chemical tests of their resinous secretions, which are frequently confused one with another, to see to what extent they agree or differ.

Shorea.

Canarium.

Hopea.

Dipterocarpus.

INDIAN DAMMARS, BOTANICAL SOURCES. The dammars likely to be used by the **Melipona** in the preparation of Burmese black wax do not include the so-called East Indian dammars exported from Singapore, the origin of which is mixed and not sufficiently known, but to those of the more restricted area of British India. These special dammars which are referred to in works on Indian products and whose properties will now be described are obtained from the following botanical sources:—

Nat. Order DIPTEROCARPACEÆ.

Dipterocarpus spp.
Shorea robusta, *Roxb.*
Shorea obtusa, *Wall.*
Hopea odorata, *Roxb.*
Hopea parviflora, *Beddome.*
Vateria indica, *Linn.*

Nat. Order BURSERACEÆ.

Canarium bengalense, *Roxb.*
„ **resiniferum,** *Brace.*
„ **strictum,** *Roxb.*

Dipterocarpus spp.

Dipterocarps The dipterocarps are lofty trees of tropical East Asia of which 17 species grow in India. They are known by yielding an oleo-resin

INDIAN DAMMARS.

or wood oil which has many useful properties and is used in the arts and medicine. The wood oil is of two kinds, Gurjan or Kanyin, a clear dark coloured oil containing 30 to 40 per cent. of volatile or essential oil, and In or Eng, a thick honey coloured granular fluid with a smaller proportion of essential oil. Gurjan oil is derived from **Dipterocarpus alatus,** *Roxb.*, found in Chittagong, Burma and the Andamans; **D. turbinatus,** *Gaertn.*, found in the same regions; **D. lævis,** *Ham.*, of Burma, and probably other species. In resin is derived from **D. tuberculatus,** *Roxb.*, and **D. obtusifolius,** *Teysm.* In the collection of the oleo-resin from the trees hardened resin often forms near the artificial openings made in the trunk, and occasionally flows down the bark and sets in stalactiform masses. This is removed and sold separately. In the Prome division of Burma the In resin is boiled in a pot with about 15 per cent. earth oil, an operation which drives off the volatile oil and leaves a hard resinous mass used for caulking boats.

Gurjan oil.

In oil

Samples of a dipterocarpus resin are sold in the bazar in Rangoon and Maulmain having a reddish-brown or dark brown appearance and occurring in stalactiform masses as if it had hardened on the trees. The names In-tsi and In-dwe indicate the natural exudations of **D. tuberculatus,** as being the chief source of the solid commercial resin.

Examination of Samples.

Examination and constants.

1. Dipterocarpus resin. Old sample.
2. Resin of **D. lævis,** Burma.
3. Resin of **D. alatus,** Chittagong.
4. Resin of *Dholia* Gurjan tree, Chittagong.
5. Soft resin of **D. obtusifolius,** "In kohe."
6. Soft resin of **D. turbinatus,** "Kanyin kohe."
7. Resin of **D. tuberculatus,** "Indwe", Maulmain.
8. Soft "Red varnish," from In tree, Burma.

	Soluble in alcohol.	Acid value.	Ester value.	Saponification value.	Iodine value.
1	52·0	24·7	44·4	69·1	49·2
2	62·0	35·9	38·0	73·9	53·3
3	62·8	44·4	64·2	108·6	74·8
4	14·5	6·2	38·2	44·4	69·6
5	97·3	17·3	24·7	42·0	12·5
6	95·1	14·8	34·5	49·4	107·6
7	41·7	30·8	41·3	72·1	50·8
8	90·0	23·6	16·5	40·1	114·0

SHOREA RESINS.

There is a great variation in the solubility of these samples in alcohol, showing that the oleo-resins or soft resins are much more so than the indurated resin containing little essential oil. The high iodine value at once distinguishes those samples in which the oil is present. The sample of hard pwê-nyet forming the opening of the nest agrees in most respects with the dried resins, Nos. 1, 2, 3, and 7. The soft commercial pwê-nyet would partake of the character of a substance formed by a combination of the oleo-resin with the dried resin of the dipterocarps. The average results of the examination of a limited number of museum specimens to some extent prove this, but the question can only be satisfactorily settled by examining a series of carefully collected field samples.

Shorea robusta, *Roxb.*

Shorea.

The Sál tree is found in the Tropical Himálaya and along its base from Assam to the Sutlej: the eastern districts of Central India and the Western Bengal Hills. The tree is not recorded from Burma by Kurz. The Burmese species is

S. obtusa, *Wall.*

Common in the In forests from Ava, Prome and Martaban down to Tenasserim, up to 2,000 ft.

Names.

The resin is known as Rál, Dhuna and Sál-dammar, and was called Resina Bengalensis in old medical works.

Resin formerly abundant.

Rál was formerly procured in considerable quantities from the Sál forests along the northern frontier of Oudh. In Bengal it was collected in Lohárdagá (including Palámau), Singbhúm, Mánbhúm and was probably imported from the forests of the Morung on the Nepál frontier. In Cuttack it was produced in the Hill States of Pal Lahára and Tálcher of the Tributary Maháls. The Khonds (Kandhs) and Wodeyas wounded the trees in several places. The resin issued from the wounds and was collected when sufficiently solid. The probable quantity annually collected in Orissa was said to be about 6,000 maunds (220 tons) which found their way to Cuttack and Balasor, nearly the whole of which was exported to Calcutta. The market price varied with the quality from Rs. 4-4-0 to Rs. 6 (5*s.* 8*d.* to 8*s.* 0*d.*) per maund (82 lbs.), near the forest, and Rs. 10 to Rs. 16 (13*s.* 4*d.* to 21*s.* 4*d.*) per maund in the towns. The retail price now in Calcutta is now about one rupee (1*s.* 4*d.*) a seer (2·06 lb.).

SHOREA RESINS.

Forest restrictions over *Sal* trees.

Sál resin was at one time the chief commercial resin in Bengal and the Central Provinces. The falling off that has taken place in its supply in the market is owing to the conservancy of the Sál forests and the adoption of other resins, chiefly pine resin, in its place. The process of extraction is most injurious to the trees and as these forests are now strictly preserved on account of the timber, the extraction has been prohibited. Until 1867 the resin was exported from Nepál into Oudh, but owing to the introduction of new forest laws by the State the exports were prohibited as in other parts of India.

Description of resin.

Sál resin occurs in brittle stalactitic pieces of a pale creamy yellow colour, nearly opaque, to a rich brown colour more or less transparent. The darkest coloured resin is that obtained from decayed portions of the tree. Each piece has a striated appearance as if the resin had run out in thin liquid streams which had hardened on the surface one over the other.

USES.

Rál or dhuna makes a good substitute for pitch, and is used as varnish by carpenters, but its consumption at present is chiefly confined to burning as incense and as medicine. It is in constant use during the ceremony of cremation at the burning ghâts throughout Bengal. One-quarter of a seer (half a pound), costing one anna, (1*d.*) is the prescribed quantity of dhuna or incense added to the fuel in the burning of a body.

Examination of samples.

Examination and constants.

1, 2 and 3. Old samples of unknown origin.
4. From Kámrúp, Assam.
5. "Rál Sakhu," United Provinces.
6. "Sál dhup," Nepal.
7. "Sál dhup," Puri.
8. **Shorea** resin from Buxár Duárs.
9. Sál dammar, Dárjiling Terai.
10. "Thitya" (**S. obtusa**), Pyinmana, Burma.

1 Dark brown, clear, with impurities. 2 Brown, transparent, stalactitic pieces. 3 and 4 Orange brown opaque masses. 5 Small, dull, light brown translucent pieces. 6 Ochreous, porous and friable masses. 7 Similar to 5. 8 Similar to 7, but more opaque. 9 Mixed rich and dull brown, transparent and opaque. 10 Dull light brown nummulitic masses.

SHOREA RESINS.

	Soluble in alcohol.	Acid value.	Ester value.	Saponification value.	Iodine value.	Ash.
1	56·7	29·1	103·4	132·5	50·8	4·1
2	58·1	34·0	67·1	101·1	52·0	·2
3	51·2	38·9	103·3	142·2	51·4	·7
4	62·0	48·6	84·0	132·6	49·7	·8
5	53·2	38·9	88·8	127·7	54·5	2·3
6	55·7	46·1	55·1	101·2	55·9	·2
7	55·4	36·4	86·5	122·9	52·0	·3
8	54·5	36·5	67·1	103·6	55·1	·7
9	53·9	34·0	74·4	108·4	53·4	·7
10	59·3	46·2	86·4	132·6	50·6	·4
Average .	56·0	38·8	81·6	120·4	52·5	1·0

The results of the chemical tests are fairly uniform. It is interesting to observe that the resin of the Burmese species of **Shorea** bears a strong resemblance in its characters to the Rál of North India. It is also interesting to notice that the resin of Dagging (**Shorea leprosula,** *Miq.*), a Singapore dammar, has a similar constitution. A sample sent by Mr. H. N. Ridley in 1905 possessed a solubility of 50·4 per cent. and an acid value of 36·2.

Hopea odorata, *Roxb.*

Hopea. Rock Dammar (Eng.) *Thingan* (Burm.). The tree grows all over Burma from Chittagong and Martaban to Tenasserim; also in the Andamans.

H. parviflora, *Beddome.*

Rock dammar. A large handsome tree common in the forests of Malabar and South Kánara, up to 3,500 feet.

Rock dammar was brought to the notice of the Agricultural Society of India in 1858 by the Rev. C. S. Parish who remarked that the pure white resin might be turned to many useful purposes and was procurable in large quantities. Dr. Barry examined the resin and reported that it was partially soluble in spirits of wine and perfectly so in benzol or oil of turpentine; the varnish was clear and limpid and dried almost instantaneously. Dr. M. C. Cooke

Description. in his report dated 1874 described its properties as follows: "The resin occurs in nodules about as large as a walnut, rounded, of a pale straw colour, sometimes almost colourless, brittle, with a shining resinoid fracture, scarcely distinguishable in appearance from the East-India dammar of the London markets. The London brokers class it as copal and value clear pale samples at a rate equal

VALUE. to that of East-India dammar, *viz.*, about 40*s.* per cwt."

SHOREA RESINS.

Later value.

The Reporter on Economic Products has lately obtained further information about the collection and use of rock dammar in Burma, and, through the Imperial Institute, a more recent valuation in the London market. Thingan is abundant in South Tenasserim especially in the Ma-lí-won sub-division. The resin exudes out of fissures in the bark during the dry weather, either by itself or from wounds made in the tree. No special methods are used for procuring a flow of resin. 3,000 or 4,000 viss (10,950 or 14,600 lbs.) could be collected in one year, at the rate of 4 annas (4*d.*) a viss = 3·65 lbs. The cost of cleaning and packing would cost one or two annas per viss extra. The dammar is not sold in the bazar, but is used locally in the arts and medicine. The fresh resin is used for caulking boats, as it liquifies on heating and hardens immediately on cooling. In Tavoy it is employed by Burmese artists for painting pictures. It is supposed to have medicinal qualities and native doctors use it for sores and ulcers; it is administered by mixing the powdered resin with honey and charcoal and applying it to the wound.

USES.

Variety of dammar.

An examination of the resin of **Hopea odorata** made at the Imperial Institute in 1903 indicated that it may be classed among the better varieties of dammar resin: a firm of varnish makers in London reported that it would be regarded as a second quality dammar, and that it could be used for the preparation of "Paper" or "Crystal" varnishes, such as are employed for indoor decorative work. Its value was about £2 5*s.* per cwt. The result of the enquiry was that as a commercial product the resin has a certain though somewhat limited demand at remunerative prices.

Examination of samples.

Examination and constants.

The following samples in the Indian Museum were chemically examined:—

1. Old sample.
2, 3 and 4. **Hopea** resins from Tenasserim.
5. Resin of **H. parviflora,** from South Kanara.

	Soluble in alcohol.	Acid value.	Ester value.	Saponification value.	Iodine value.
1	74·7	28·4	38 3	66·7	91·8
2	74 9	28·4	33·4	61·8	96·3
3	76·1	33·3	43·3	76·5	90·6
4	71·5	35·8	25·9	61·7	98·4
5	74·8	40·8	33·3	74·1	84·4
Average	74·4	33·3	34·8	68 1	92·3

HOPEA RESINS.

The melting points of the original resins were 99° to 110°; of the soluble resins, 80° to 100°; and of the insoluble resins, 152° to 178°. The samples of **Hopea** resin are more soluble in alcohol than those of the **Shorea** and the indurated resins of **Dipterocarpus.** The saponification values of the **Hopea** resins are higher than those of the **Dipterocarpus,** and lower than those of the Sál, while the iodine values of the **Hopea** resins are higher than both the others. Here again may be noticed the agreement in chemical characters between the resins of different species of **Hopea** growing in widely separated localities.

Vateria indica, *Linn.*

Vateria indica.

A large evergreen tree of the Western Peninsula from Kanara to Travancore, ascending 4,000 ft.

South India.

The exudation of this tree is called White Dammar of South India, Piney resin and Indian Copal. The tree is known locally as Dupada and Pinne, and the resin as Vellai-Kungiliam.

Three forms of resin.

Piney varnish is obtained by making notches in the tree, when it exudes in a liquid state and gradually hardens. According to the Jury Report of the Madras Exhibition, 1857, it occurs in three forms: 1st Compact Piney resin; 2nd Cellular Piney resin; and 3rd Dark coloured Piney resin. The better varieties are dull or bright, orange or yellow to amber coloured masses, breaking with a bright vitreous fracture. It was examined about 40 years ago by Mr. Broughton of Ootacamund, who reported that it surpassed copal in its greater solubility, and its varnish dried with great purity and whiteness.

Not commercially important

The resin could be obtained at about Rs. 6 (8*s.*) per maund of 25 lbs., but it is not an article of any commercial importance. It is frequently confounded with East-Indian Dammar, such as the sundras resin from Zanzibar and dammar resin from Singapore. It is used chiefly as incense, for varnishes and in medicine. Given in the form of powder it is said to check diarrhœa. The fresh resin combined with oil is occasionally made into crude candles.

Examination of samples.

Examination.

Some of the samples of this resin in the Indian Museum are evidently those of imported dammars from the Straits and Zanzibar. It has been noticed in many works on Indian products that **Vateria indica** has been used as a convenient name under which to place descriptions of and information on all dammar resins in general.

VATERIA RESINS.

After rejecting those not sufficiently authenticated, the following four were selected for analysis:—

1. **Vateria indica** resin from Madras.
2. White dammar from South Kánara.
3. **V. malabaricum** resin from Madras.
4. **Vateria** (?) resin from Madras.

Nos. 1 and 3 were orange yellow stalactiform pieces, transparent with opaque portions.

2 clear light yellow with glassy fracture.

4 orange yellow somewhat opaque.

Constants.

	Soluble in alcohol.	Acid value.	Ester value.	Saponification value.	Iodine value.
1	61·7	24·7	56·8	81·5	62·1
2	50·9	42·0	46·9	88·9	61·5
3	59·4	39·5	34·6	74·1	63·2
4	69·3	77·8	3·7	81·5	60·5
Average .	57·3	35·4	46·1	81·5	62·2

The average result of constants is calculated from the first three samples, the fourth not being sufficiently authenticated and having a higher acid value.

Canarium resins.

Canarium bengalense, *Roxb.*

A tall tree met with in the Eastern Himálayas, Sylhet and Assam.

C. resiniferum, *Brace MSS.*

Assam [*Journ. Asiatic Society Bengal*, lxii (1893), II, 4, 188].

C. strictum, *Roxb.*

Black Dammar tree. Resin: *Karapu-Kongiliam*, Tam. Common in Tinnevelli and Kánara in South India.

Black Dammar.

The resins of these widely distributed trees have a similar appearance. It occurs in black shining masses, but when held up between the eye and the light it is transparent and has a deep brownish-yellow or amber colour. It is not unlike copal, but the natives set little or no value upon it. In Dr. Roxburgh's time in

Description.

CANARIUM RESINS.

the Calcutta bazar it was only valued at two or three rupees (2*s.* 8*d.* to 4*s.* 0*d.*) a maund (82 $\frac{2}{7}$ lbs.). It is used as incense by the Lepchás in Sikkim, where it is known as *Googal dhup*.

USES.

In South India black dammar was formerly obtained by the destructive method of cutting gashes in the lower part of the stem and then setting it on fire. There is a small trade in the article and it is used in the manufacture of bottling wax and varnishes. It was examined by Mr. Broughton who found that though insoluble in spirit, its solution in turpentine formed a tolerable varnish. In its possible applications it however possesses few advantages over ordinary resinous substances.

Value.

Its price on the Malabar Coast, Rs. 8 (10*s.* 8*d.*) per 25 lbs., is about ten times the price in England of common rosin which sold for 7*s.* 6*d.* per cwt.

One or two correspondents in Assam having lately enquired about a possible trade in **Canarium** resin, the Reporter on Economic Products procured through the Imperial Institute a further valuation and opinion regarding the resin in the London market. A firm of varnish makers reported that the resin was suitable for the preparation of a hard drying varnish, such as is required in the preparation of enamel paints. The dark colour of the resin would, however, to some extent prejudice its sale, and it was unlikely that a higher price than 18*s.* per cwt. would be obtained for it.

Not a profitable product.

The Deputy Commissioner of Forests reports that **Canarium bengalense** is not gregarious and is scattered over a large tract of country, and this circumstance enhances the cost of collection. The resin is estimated to cost 6 as. (6*d.*) per seer (2·06 lbs.) or Rs. 15 (20*s.* 0*d.*) per maund, (82 $\frac{2}{7}$ lbs.) equal to 28*s.* per cwt. Adding to this the freight to Calcutta and London, it is evident that there would be a considerable loss in any attempts to commercially exploit the article.

Local opinion.

A large sample of the resin was supplied to a Calcutta firm of paint and varnish manufacturers to ascertain if there was any local demand for it. The manager, after testing the sample, replied that it yielded a poor quality of varnish and left a considerable quantity of residue. He added, "The sample is not equal to Gum Dammar which we import from Singapore at a cost of Rs. 48 (64*s.*) per cwt. from which a clear varnish is obtained and leaves no residue."

The unfavourable opinion agrees with that expressed by Dr. Roxburgh in "Flora Indica" about a hundred years ago. It only remains therefore to ascertain how **Canarium** resin compares in composition with the Indian dammars previously discussed.

Examination of samples.

CANARIUM RESINS.

Examination.

Of the samples examined in the Indian Museum, two were of **C. strictum,** one of **C. bengalense,** and one of **C. resiniferum.** The two remaining samples were sent under other names, but their appearance and properties betrayed them as black dammars.

1. **C. strictum,** Tinnevelli, Madras.
2. "Karruppu kungiliam," Cumbum, Madras.
3. **C. bengalense,** "Dhuna," Jorhát, Assam.
4. **C. resiniferum,** "Karail," Cachar.
5. Sent as resin of **Aquilaria Agallocha,** Golághát.
6. Sent as **Vateria indica** resin, South India.

Description.

The specimens were all brown or dark brown, transparent, brittle resins.

Constants.

	Soluble in alcohol.	Acid value.	Ester value.	Saponification value.	Iodine value.
1	12·9	6·2	35·8	42·0	45·1
2	18·2	7·4	37·0	44·4	45·1
3	23·1	8·6	33·4	42·0	41·8
4	11·9	6·2	43·2	49·4	46·7
5	13·9	5·6	41·3	46·9	42·2
6	24·6	8·6	28·5	37·1	43·5
Average	17·4	7·1	36·5	43·6	44·0

In this resin the solubility and other constants are lower than in all the other Indian dammars.

Summary.

SUMMARY.

The examination of these resins has not been very exhaustive but the application of a few simple analytical tests has resulted in showing that each exudation from a generically botanical source has distinguishing properties. A table of the average constants will show how they vary. The difficulty connected with the dipterocarpus resins on account of their variability was settled by taking the average of Nos. 4 and 5 as these samples had been freshly collected from trees which were identified in 1904 by Lieutenant-Colonel D. Prain at Sibpur. Accepting these as representative,

Dammars have peculiar constants.

SUMMARY. and arranging the averages according to their solubility, the following interesting table results:—

	Soluble in alcohol.	Acid value.	Ester value.	Saponification value.	Iodine value.
Dipterocarpus .	96·2	16·0	29·7	45·7	117·7
Hopea . .	74·4	33·3	34·8	68·1	92·3
Vateria . .	57·3	35·4	46·1	81·5	62·2
Shorea . . .	56·0	38·8	81·6	120·4	52·5
Canarium . .	17·4	7·1	36·5	43·6	44·0

A natural series. The dipterocarpaceous resins naturally fall into a series where it is observed that the iodine value decreases with the solubility, and coincident with the decrease there is a gradual rise in the acid, ester and saponification values. **Canarium** resin, belonging to a different natural order, does not follow this rule. It is remarkable to discover in the properties of these resins the elements of a periodic law in the vegetable kingdom. It is hoped that opportunity will be afforded for following up the subject.

Elements of periodic law.

Analytical value of results. The table has, also, analytical value since it enables a sample of bazar resin of Indian origin to be referred with some restrictions to its botanical source. It has proved useful in the Indian Museum in determining samples of resin sent for identification, and in correcting those sent under a wrong name.

Pwe-nyet allied to resin. With regard to the origin and composition of pwê-nyet, the special objects kept in view in compiling the present article, it will be seen that the best quality, according to its constants, will occupy a position in the table between **Dipterocarpus** and **Hopea** resins. The constants, it will be remembered, are: Solubility 86.2, acid value 28·3, ester value 23·9, saponification value 52·2, iodine value 137·1. The composition of the exterior portions of the nest agrees in many respects with the dried resin of **Dipterocarpus tuberculatus,** in a chemically unaltered condition.

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THE

AGRICULTURAL LEDGER

1908-09—No. 4

URENA LOBATA

(FIBRE)

The use of **Urena lobata** *as a fibre material and as a possible substitute for jute. A review of existing information. By* REGINALD ABBEY-YATES.

References.—*Roxb. Fl. Ind., Ed. C.B.C., 519; Dalz. and Gibs. Bomb. Fl., 18; Royle, Fib. Pl., 263; Thwaites En. Ceyl. Pl., 25; Hooker, Fl. Br. Ind., I., 329; Ind. Kew. IV., 1149; Mason, Burma and its People, 520, 755; Drury, Useful Pl., 437; Liotard, Paper Materials, 31; Murray, Pl. and Drugs, Sind. 61; Mukharji, Catalogue, Ind. Prod., Amsterdam Exhib., 161; Watt, Catalogue Calcutta Exhib. III, No. 290; Lisboa, Useful Pl., Bomb., 228; Campbell, Catalogue Econ. Prod. Chutia Nagpur, No. 7896; Watt, Guide to Econ. and Com. Court, 206; Cross, Bevan and King, Rep. on Ind. Fib., 9, 43; Atkinson, Himalay. Dist., 306; Gazetteers:—Mysore and Coorg, I., p. 58; Bomb., XV. (Kánara), 427 XXI, (Botany), 228; N.-W. P. IV. (Agra) lxviii; Agri. Hort. Soc. Ind. Journ. (Old Ser.) IX, 405, Sel., 47; Journ. Soc. of Arts (Cantor Lectures) XLIII (1895), 407-8; Dodge, Useful Fibre Pl. of the World, 321, 322; Agric. Ledger, 1896, No. 11, p. 2; No. 37, p. 25; Haines, Forest Working Plan, Jalpaiguri, 1898, xxvii; Ann. Report, Gov. Gardens, Mysore, 1899-1900, 17; Upendranath Kanjilal, Forest Flora, School Cir., N.-W. P., 37; Ind. Forester, XXVIII (1902), 75; Cooke, Fl. Bomb., I., 100; Duthie, Fl. Upper Gangetic Plain, I, 85; Firminger, Gardening for India, 5th ed., 650; Records, Bot. Survey, Ind., III, 2, 178; Anglo-Ind. Review (1905), 34; Imperial Inst. Tech. and Sc. Rep. (1903), 108-9; Imperial Inst. Bulletin, I, (1903) xxiv, III (1905) 262, V. (1907) 9, 10, VI. (1908),134, 135; "Capital," 1903, Aug. 6, Oct. 22, Nov. 12, 1904, Jan. 14, 21, 1907, Jan. 10, 1908, Sept. 17; Ridley, Malay Pl. Names, Journ. Roy. Asiatic Soc. Straits Br., No. 30 (1907), 135, 206, 213; Agric. Bull. Straits and F. M. States, IV. (1905), 157; Tropenflanzer, IV. (1900), 562, VI. (1902), 427; L'Agricult. pratique des pays chauds, III. (1904), 692; Journal Officiel de Madagascar, No. 834 (1903), 9984; Bulletin Economique, Madagascar, IV (1904) 33, VIII. (1908) 64; Kew Bulletin, 1890, p. 198, 1891, p. 219; Additional Ser. No. II. (1898), 277, 278; Colonial Reports, Misc. No. 51 (1906) 40; Dodge, Report on Uncultivated Bast Fibres of U. S., 14; Board of Trade Journ. XXVII. (1899) 738, LXII. (1908) 91; Jornal do Commercio, Rio, reprinted in "Planting Opinion" (1899) 1905; Dipl. and Con. Rep., Annual, No. 2475 (1899) 25, No.*

2928 (1903) 11, No. 3823 (1904) 17-19; Trop. Agric. XIX. (1900) 481, XXI. (1902), 603, XXII (1903) 690; Rev. des Cult. Coloniales, X. (1902) 49, XI., 105; British Trade Journal, XLI. (1903), 58; Ind. Gardening and Planting, 1903, Aug. 29; Textile Mercury XXIX. (1903) 251, 252; Journal d'Agric. Tropicale, IV. (1904), 190; Medicinal Plants of Java, Asiatics Journ. VII (1819) 266; Quarterly Journ. of Agri. VIII. (1857), 164; von Mueller, Select Pl. for Extra-Trop. Countries, (Ind. ed. 1880) 340; Agric. News, West Indies, (1902) 189; Spon's Encyclopædia, I., 999; Agri. Journ. of India, III., 333 (Oct. 1908).

INDIA.

Vernacular names.

Among the inhabitants of India the plant botanically known as **Urena lobata** is variously spoken of as—

Bun-ochra, ban okra, bun-chra, bun-kra, BENG.; *Sonborial, lakna,* ASSAM; *Lara, Seth lehra,* CHITTAGONG; *Bhidi janetet,* SANTAL; *Bachita, kukar chalni,* U. P.; *Unga,* DÚN; *Kharata,* SAHARANPUR; *Bariyari,* JEYPORE; *Villiah,* KONKAN; *Vana-bhenda,* MAR.; *Tuttinaar* (Urena sp.), TRAVANCORE; *Kat-sae-nai,* PEGU; *Wet-kyae-pa-nai,* BURM.; *Kasis-bin, Petna,* THARRAWADDY; *Kasil-me, kasihne,* YAMETHIN, *Phapy ban,* AKYAB; *Ze-nu or katse-ne,* YAUNGTHABIN, PROME.

Names of the plant in other countries.

The following are some of the names by which the plant is known out of India—

Pulut-Pulut, pepulut, MALAY; kelulut, perpulut, POKO; Toja, WEST AFRICA; Ake-iri, YORUBA LAND; Otóto grande, St. THOMÉ; Kiriza, sikilenja, MADAGASCAR; Cousine mahoe, GRENADA, TRINIDAD; Grand cousin, cousin-rouge, GUADELOUPE; Grand-mahot-cousin, MARTINIQUE; Cæsar weed, FLORIDA, U. S.; Cadillo, VENEZUELA; Aramina, Carrapicho, guaxima, uaixyma, BRAZIL.

The fibre variously spoken of in Brazil as aramina, carrapicho, guaxima, etc., is believed to be derived chiefly from **Urena lobata** and other species of **Urena.**

From experiments made at the Royal Botanic Gardens, Sibpur, Calcutta, however, with seed furnished from Brazil, it would appear that Aramina fibre is obtained in part at least from another plant which like **Urena** also occurs in India, *viz.*, **Triumfetta rhomboidea,** *Jacq.* The latter is known in the vernacular as *chikti, bun-ochra,* etc. It will be noticed that in certain localities the name bun-ochra is common to both plants. A similar case occurs in the Malay Peninsula where the two plants **Urena** and **Triumfetta** are known by the common name of *pulut pulut* (H. N. Ridley in *Agric. Bull., Straits and F. M. States,* V [1906] 199).

Introductory.

Urena lobata has of late been much discussed in various parts of the world as a possible jute substitute. The experience of those who have exploited the plant for its fibre cannot, however, be said to have been encouraging: on the other hand, such experiments on

a large scale seem to have been mainly confined to one country, *viz.*, Brazil. INDIA.

In any case, the bringing together of existing information in a convenient form for reference will, it is thought, prove useful to those interested in the subject of substitutes for jute and other fibres.

Habitat.

An erect, much-branched shrub, generally being 2 ft. to 4 ft. high with solitary, rather conspicuous pink flowers and 5-lobed nearly round fruits covered with small hooks. The stems and leaves have a white, thick, somewhat rough, hairy covering. Description of the plant.

The plant is extremely variable in size and shape of its leaves. It grows wild all over the hotter regions of India, particularly in waste areas on the edges of forest roadsides, etc. It flowers in the later part of the rains and through the cold weather. It yields a fibre which is of the jute type, but the staple is generally short, though stronger. Royle speaks of it as a tolerably fine substitute for flax. Occurrence. Fibre. Dr. Royle's opinion of it.

The following paragraphs give an account of its use as a fibre plant in India.

It is said to be known in Assam as the *lakna* or "jangli jute" of Assam. Specimens of the fibre were shown at the Calcutta Industrial Exhibition of 1906-07. Ropes are made of it in Cachar where it grows profusely and is said at times to attain 8 ft. in height on land that has been cleared of jungle and not well cultivated afterwards. In Golaghát the plant goes by the name of Sonborial, sometimes incorrectly written bon borial. There are stated to be two kinds, small and large. The fibre is by some confused with that of Rhea (**Boehmeria**) and by others with Bon Rhea (**Villebrunea**). Ropes of Sonborial (**Urena lobata**) fibre are greatly in favour with both Assamese and Bengalis. They may be met with on ticca carts; and coolies employ these ropes for carrying loads banghy-fashion to market. The fibre is considered to be very strong and durable. In Pegu, Burma, it is one of the most plentiful of weeds and it is used as a fibre plant to a small extent. Mr. L. Aubert, Superintendent of Land Records in 1906 sent to the Reporter on Economic Products through Mr. A. E. Rigg, the Deputy Commissioner, the information that in Yamethin fibre is prepared from the wild plant, and the Reporter on Economic Products in the current year found that in villages near Prome it is also prepared. In 1896 the Deputy Commissioner, Tharrawaddy, reported that it was a fibre Urena fibre finds use in Assam. In Burma.

INDIA.

plant of his district, but without distinctly stating the extent of its use.

Over the rest of India it seems that the fibre has no indigenous use.

Cultivation.

A wild plant, not cultivated.

The plant is a common weed and so far as known has not hitherto been tried in this country as a field or garden crop. Its growth is said to be rapid and to require no special care.

Preparation of the Fibre.

Fibre, how prepared in Burma.

Mr. L. Aubert, Superintendent of Land Records, describes the method pursued in the Yamethin district, Burma, thus:—"An incision is made all round the lower end of the stem of the grown up matured plant. The epidermis comes off readily, and the ligneous portion is thrown aside. Having separated the bark from the fibrous portion under it, the latter is dried in the sun for a couple of days.

When required to be made into rope the fibrous mass is soaked for a week or ten days in water. At the end of that time, it is placed on the slab and beaten with a mallet to remove all the fleshy matter. A final washing leaves the pure fibre which is placed in the sun, but not allowed to dry completely, and is twisted into rope. If too dry, it should be moistened before twisting.

An inferior kind of rope is also made with the epidermis which is not thrown away, but is used by cultivators of the poorer class for binding the yokes of their ploughs and carts."

URENA LOBATA FIBRE AS IT OCCURS OUT OF INDIA.

Urena lobata, utilisation of the fibre in other countries.

Under the common name of the Cæsar weed, it is described by Dodge in his *Descriptive Catalogue of Useful Fibre Plants of the World*, which should be consulted.

Straits Settlements.

The Straits.

From the *Agric. Bulletin of the Straits and F. M. States* IV (1905), 157, we learn that the fibre is said to be very white and a metre in length, and to take colour well. It is very strong and makes good cordage. The author concludes by stating that it does not seem that it has ever been put under cultivation, and it is doubtful if it would pay if it was.

Madagascar.

OUTSIDE INDIA: Madagascar.

Particulars regarding **Urena lobata** fibre appeared in the *Journal Officiel de Madagascar* of the 9th September 1903 and in the *Bulletin Economique, Madagascar*, IV, (1904) 33 and VIII (1908), 64. The fibre is known locally as *Kiriza* and *Sikilenja*.

West Africa.

West Africa.

The plant is known as Toja in West Africa where it finds use among the Yorubas and Haussas for making ropes and for other purposes. It is plentiful but is not cultivated. In *Colonial Reports—Misc. No. 51, Forest Administration, Southern Nigeria*, 1906, p. 40, it is stated of **Urena lobata** that it is common on waste places, round villages and recently abandoned farms. By cultivation the length of fibre can be increased. It would be interesting to know if the statement made in the sentence last quoted is the result of the writer's own experience.

United States.

United States.

The plant is common in Florida, and abounds in South America (*Dodge, Report on Bast Fibres of the U.S.*, 1894, p. 14.) By uninformed persons it is taken for ramie (**Boehmeria**).

Venezuela.

Venezuela.

Dr. Ernst, Director of the National Museum, Caracas (quoted by Dodge), describes the fibre as very fine, white in colour and a metre in length. It is very strong and takes dye readily.

Brazil.

Brazil.

As already stated **Urena lobata,** or as the plant is termed locally "guaxima," was at one time regarded as likely to prove an efficient substitute for jute. The first account of it which is recorded in the office of the Reporter on Economic Products appeared in the *Jornal do Commercio* and was subsequently given in the *Board of Trade Journal*, XXVII (1899), p. 738. It is included here to show local conditions: it must be remarked, however, that the writer was evidently not conversant with the method of preparing jute in India when he speaks of "maceration in vessels." "A correspondent of the *Jornal do Commercio* of Rio de Janeiro draws attention to the fibre of the guaxima, which grows wild everywhere, but is found in largest quantities on the low lands near the sea. It is believed that this fibre would prove an excellent substitute for jute, which

OUTSIDE INDIA. Brazil.

is all imported, and when cultivated prove the basis of an important industry.

The threads are long and very strong and will resist the action of water; the fibre being used by fishermen on the coast for their nets, which last for years if soaked in a tincture of aroeira* bark.

The process of elaboration of the guaxima fibre does not require long maceration in vessels, as is the case with jute; immersion for a few days in running water being sufficient to loosen the green outer bark with the hands, after which the rods are exposed to the sun in order to dry the woody part: this then contracts and allows the fibres to be easily separated."

In this connexion Mr. Acting Consul General Rhind writing on the Trade of Rio de Janeiro for 1899 (*Dipl. and Consular Reports, Annual Series* No. 2,475) makes this apposite remark:—It must be borne in mind that the plant [**Urena lobata**] occurs only in a wild state and in scattered quantities, so that, even should it be proved to possess the necessary qualities for industrial manipulation, there will be still the question whether it can be systematically cultivated to yield regular marketable supplies for manufacturing purposes at a cost which will allow it to compete with jute.

That the foregoing remark was fully justified in the light of subsequent events will be evident further on.

The interest aroused in the so-called new fibre received a further impetus in 1902, as will be seen from the passages quoted below which appeared in the *Tropical Agriculturist*, XXI (1902), 603:—

"According to the *Bulletin of the Bureau of American Republics*, a new fibre known as *aramina*, has recently been discovered by Dr. Silva Telles of the Polytechnic School of Sao Paulo. This fibre is obtained from a variety of plants commonly known in Brazil as carrapichos. It is almost white in colour, very fine and flexible, and is from two to three yards in length. It has been called *aramina* owing to its almost metallic lustre and wonderful flexibility. The plant from which the fibre is derived is strong and vigorous, and no special care is required in its cultivation, being perfectly adapted to uncultivated lands. It grows wild throughout the entire western part of the State of Sao Paulo and is being cultivated on a larger scale in the vicinity of Campinas.

Articles made of this fibre were recently exhibited by Dr. Telles at the Polytechnic School, Sao Paulo. These included cords, twines, ropes, and canvas suitable for coffee bags.

*Among the plants known in Brazil by this name are three spp. of ASTRONIUM, one of LITHRÆA and two of SCHINUS. All belong to the Anacardiaceæ. Schinus molle and S. terebinthifolius are probably those here referred to.

It is predicted that this discovery will revolutionise the textile industry."

OUTSIDE INDIA: Brazil.

We next find the fibre mentioned in the *Rev. des Cult. Coloniales* X, (1902) 49, under the synonym, **Urena trilobata** which with the plant **Triumfetta semitrilobata** is stated to yield the fibre called Aramina. The writer goes on to say that the plant yields 7 to 8 per cent. of fibre, while ramie gives 3 per cent.; the cultivation being cheaper; and adds it is much stronger than jute.

The new enterprise is discussed in "*Capital*," Calcutta, August 6, 1903, with regard to its possible bearing on the jute export trade of Calcutta.

That journal in its issue of the 12th November 1903 reproduces certain passages from the *Dundee Advertiser* regarding the alleged unfitness of aramina fabric for the manufacture of coffee bags. In the same place is given a somewhat unfavourable report—of too technical a nature to be reproduced here—by an expert in Dundee to whom the bag was submitted. But it is far from proved that the nameless expert was right. The expert concludes by stating that perhaps the fibre would be serviceable as a waterproof material.

The real reason why the aramina industry has not made headway is insufficient supplies of the material, or as recorded in *Diplomatic and Consular Reports No. 3283 Annual* (1903), 17-19, the neglect of sufficient systematic planting, excessive cost of production, or to the imperfections in the manufacturing process. It appears, in any case, not to be unfitness of the material for weaving purposes.

The latest recorded particulars regarding the aramina industry of Brazil are to be found in a report by H. B. M. Consul at Santos, the following extract from which is taken from the *Board of Trade Journal*, LXII (1908), 91:—

"It was thought that a substitute for jute had been discovered in the aramina plant which grows wild, but under cultivation it lost a great part of its fibrous nature, and as the supply of the wild plant was wholly insufficient, a mill, put up at a cost of some £24,000, had to be shut down, and after undergoing the necessary transformation, is now used for the manufacture of hessians." In the same connexion "*Capital*," Calcutta, 17th September 1908, may also be consulted.

Chemistry.

The earliest recorded examination of the fibre, is that mentioned in the *Report on Indian Fibres and Fibrous Substances, exhibited*

CHEMICAL COMPOSITION.

CHEMICAL COMPOSITION.

at the Colonial and Indian Exhib., 1886, by C. F. Cross, E J. Bevan and C. M. King, 1887, p. 9.

Urena lobata.

Report by Messrs. Cross, Bevan and King.

Moisture	10·7
Ash	1·8
Hydrolysis (*a*)	11·9
Hydrolysis (*b*)	18·5
Cellulose	77·7
Mercerising	13·6
Nitration	...
Acid purification	4·0
Carbon percentage	...

Sir Daniel Morris' account of the fibre.

The next important reference to **Urena lobata** fibre will be found in the Cantor Lectures by Sir Daniel Morris, K.C.M.G., who speaks of it thus (*Journal of the Society of Arts*, XLIII [1895] 407-8):—"A very variable plant, widely distributed in the tropics. In India the easily extractable fibre is considered suitable for the manufacture of sacking and twine, and a fair substitute for flax. 'The Toja' fibre of West Africa is yielded by this plant. . . The fibre bundles are indistinguishable from characteristic *hibiscus* fibre. The filaments or cells are short, scarcely more than 1·5 to 2 mm. long."

Its examination at the Imperial Institute.

An examination of a sample of the fibre here referred to was subsequently made in the Research Department of the Imperial Institute, the results of which are given below:—

Moisture	9·9 per cent.
Ash	2·4 ,,
Loss by (*a*) Hydrolysis	12·2 ,,
Loss by (*b*) Hydrolysis	16·3 ,,
Loss by Mercerising	15·7 ,,
Loss by Acid purification	3·0 ,,
Gain by Nitration	25·8 ,,
Cellulose	73·5 ,,
Length of ultimate fibre	2·2—·5 ,,

Report of Research Department, Imperial Institute, on Aramina fibre from Brazil.

In 1902 a sample of Aramina fibre was forwarded by Mr. Rhind, H. B. M. Consul-General at Rio de Janeiro, to the Imperial Institute (*Technical and Scientific Reports, Imp. Institute* [1903], 108, 109), with the following result:—"The sample sent by Mr. Rhind was almost too small for systematic examination. On this account the remarks made in this report must be regarded as provisional, a decisive opinion as to the value of the material being reserved until a larger quantity has been examined.

The specimen consisted of fine silky fibre of great length in staple, having in general the characteristics of the best jute, but

very much less lignified and of good colour. The result of its chemical examination are recorded in the following table:— CHEMICAL COMPOSITION.

Moisture	13·38 per cent.
Loss on (*a*) Hydrolysis	17·69 ,,
Loss on (*b*) Hydrolysis	17·56 ,,
Loss on Acid purification	2·5 ,,
Loss on Mercerising	19·37 ,,
Gain on Nitration	35·65 ,,
Cellulose	75·73 ,,
Length of ultimate fibre	1·5 —3·5 mm.
Length of stable	6 feet.

These results show that the fibre is of excellent quality, owing to the considerable length of staple, the high percentage of cellulose, and a small loss by acid purification. The numbers recorded show considerable resemblance to those obtained from jute of the best quality."

From *Dipl. and Cons. Report* No. 3283 Annual (1903), 17-19, we learn that a second sample of Aramina fibre was received at the Imperial Institute. The results side by side with those obtained from the examination of an Indian sample are given in the following table (*Bulletin of the Imp. Institute*, III [1905], 262):— Further examination of Aramina fibre. Professor Dunstan's Report.

——	*Urena lobata* from India.	"Aramina" fibre from Brazil.	Indian Jute, extra fine quality.
Moisture per cent.	9·9	9·3	9·6
Ash, per cent.	2·4	0·7	0·7
A—Hydrolysis, loss per cent.	12·2	10·2	9·1
B—Hydrolysis ,, ,,	16·3	18·2	13·1
Acid purification ,, ,,	3·0	1·9	2·0
Cellulose, per cent.	73·5	76·0	77·7
Length of ultimate fibre	2·2—5·0 mm. or 0·09—0·2 inch.	1·5—3·5 mm. or 0·06—0·14 inch.	1·5—3·0 mm. or 0·06—0·12 inch.

Under date, 30th September 1907, Professor Wyndham R. Dunstan reported on the results of the examination of Urena fibre from India. The sample consisted of about 2 oz.—too small and not sufficiently well cleaned for chemical examination. *Description*, somewhat harsh, greyish fibre, gummy and in parts woody. *Strength*, uneven, very fair on the whole. *Length of staple*, up Report of Professor Dunstan on the Indian fibre.

CHEMICAL COMPOSITION.

to 6 feet, average about 4 feet. The report concluded with these remarks:—

"The fibre is obviously insufficiently retted as it is stiff and gummy, and the fibres have not separated properly. It resembles the sample of the "Aramina" fibre from Brazil previously examined in the Scientific and Technical Department ("See Bulletin of the Imperial Institute," Volume I, page 24,) and is, like the "Aramina" fibre, decidedly harsher than jute.

The present sample is regarded by experts as suitable for spinning and would probably be useful for mixing with jute. There is little doubt that a softer and much better product could be obtained by more careful retting. Attention should also be directed to the length of the material. The present sample is of very irregular length, some of it being of good length (about 6 feet) whilst the larger proportion was only 4 feet or less."

Gambia.

Professor Dunstan's Report on specimen from the Gambia.

A sample of **Urena lobata** fibre received from the Gambia was soft, of a greenish-grey colour, well cleaned and prepared, fine, lustrous, of good strength and about three feet long (*Bulletin, Imperial Institute*, VI [1908], 134, 135). On chemical examination it gave the following results:—Moisture 10·9, Ash 0·4, A-Hydrolysis (loss) 9·8 B-Hydrolysis (loss) 16·3, Acid purification (loss) 1·3, cellulose 74·6, per cent. In chemical composition and behaviour the fibre was superior to a specimen of "medium quality" Indian jute, with which it was compared. It was only half the usual length of jute but would nevertheless be readily saleable as a jute substitute at £17 per ton (with "medium" jute at £15 to £17 per ton). It was suggested that a consignment of the well-prepared product should be forwarded for trial sale.

Madagascar.

BREAKING STRAIN OBSERVATIONS.

The *Journal Officiel de Madagascar* dated the 9th September 1903 records the following observations:—

A thread of **Urena lobata** fibre 2 millimetres in diameter and 1 metre in length broken under a weight of 14 kilogrammes, while a thread of Italian hemp (**Cannabis sativa**) of the same dimensions broke under a weight of 40 kilogrammes.

BREAKING STRAIN OBSERVATIONS.

Strength of **Urena lobata** *compared with that of* **Abutilon indicum** *and other fibres.*

Report on the examination of nine samples of fibre received from the Director, Land Records and Agriculture, United Provinces, on the 31st January 1906, by D. Hooper.

The samples were marked as under:—

1. URENA LOBATA (No. 25,391) Before flowering, kept in water 6 days.
2. URENA LOBATA with flowers, but before the seeds are ripe in water for 8 days.
3. URENA LOBATA seeds almost ripe. In water for 8 days.
4. URENA LOBATA Thread, roughly prepared.

No. 1.	Breaking weight	636	Fair colour, towey.
No. 2.	„ „	533	„ „ „
No. 3.	„ „	383	„ „ „ weak.
No. 4.	„ „	775	coarse thread.

The figures which follow are given for purposes of comparison.

5. ABUTILON INDICUM (No. 25,392) kept in water 6 days.
6. „ „ (No. 25,392) „ „ „ 8 days.
7. CROTALARIA JUNCEA (No. 25,393) "Sunnai."
8. HIBISCUS CANNABINUS (No. 25,394) fruits ripe.
9. CORCHORUS CAPSULARIS (No. 25,395) jute.

No. 5.	Breaking weight	342	clean white bast, weak.
No. 6.	„ „	372	„ „ „ „
No. 7.	„ „	333	towey, of little value.
No. 8.	„ „	546	silvery white bast, slight tow.
No. 9.	„ „	596	fibre slightly discoloured.

Prices and Market value.

PRICES.

Sir Daniel Morris mentions (Cantor Lectures, *Journ. Soc. Arts*, XLIII [1895] 407-8), that samples sent to Kew in 1889 were valued at £17 to £18 per ton.

Brazil.

The Acting Vice-Consul at Rio (*Dip. and Consular Rep. No. 2928 Annual* [1903], p. 11), describing the progress made in working the fibre gives the price paid in Sao Paulo for clean aramina as about 1*d.* per lb.

PRICES. Urena vs. ute.

"*Capital*" in its issue of the 14th January 1904 reviews a communication received from the same source. It is there stated that the factory at Sao Paulo was offering 200 to 300 reis per kilo (say £10 to £15 per ton) for the bark, clean, drier and ready for manipulation, and the Consul adds, there seems no desire for the business even at the higher price (Cf. *Journal d'Agricult. Tropicale*, 1904, p. 190). The local cost of Aramina material fibre in 1903 is stated by Mr. Consul Rhind (*Dip. and Cons. Report* No. 3823 *Annual* [1904], p. 19), to have been at the rate of £15 per ton for bark and £60 per ton (about) for fibre.

As regards the price likely to be realised by **Urena** fibre in London, the undermentioned valuation will be seen to be the same as that placed on the samples sent to Kew in 1889.

In 1902, a portion of the sample of **Urena lobata** fibre received from Mr. Rhind was submitted* with a statement of the results of its chemical examination to a well-known firm of fibre brokers, who reported that it could be employed for the same purposes as fine jute. Its value was estimated approximately at from £17 to £18 per ton. The brokers stated, however, that it was impossible to give the precise value of the fibre until a much larger quantity had been examined with special reference to its behaviour during spinning, weaving, and other processes to which it would be submitted. They suggested that a hundredweight or two should be sent in order that these further trials might be made.

India.

In his report on the results of the examination of **Urena** fibre from India, Professor Dunstan gives as the commercial value—£12-10*s.* to £13 per ton for spinning in admixture with jute. Medium jute was quoted at £15 to £17 per ton on the same date—30th September 1907.

A subsequent communication stated that if the fibre were more carefully retted and prepared, it would undoubtedly realise a higher price than that quoted in the report. Previous specimens of **Urena** fibre examined at the Imperial Institute have been valued at approximately the same prices as "medium" jute, which was quoted at £15 to £17 per ton when this sample of **Urena** fibre from India was valued at £12-10*s.* to £13 per ton.

The market price of **Urena** fibre would always be determined by the current value of jute; at present "medium" jute is quoted at from £14 to £16 per ton.

* by the Imperial Institute authorities.

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AGENTS.

In Europe.

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Messrs. Constable & Co., 10, Orange Street, Leicester Square, W.C.
Messrs. Kegan Paul, Trench, Trübner & Co., 43, Gerrard Street, Soho, London, W.
Mr. Bernard Quaritch, 11, Grafton Street, New Bond Street, W.
Messrs. P. S. King & Son, 2 and 4, Great Smith Street, Westminster.
Messrs. H. S. King & Co., 65, Cornhill, and 9, Pall Mall, London.
Messrs. Grindlay & Co., 54, Parliament Street, London, S.W.
Mr. T. Fisher Unwin, 1, Adelphi Terrace, London, W.C.
Messrs. W. Thacker & Co., 2, Creed Lane, London, E.C.
Mr. Karl Hiersemann, Mr. Otto Harrassowitz } Leipzig.
Messrs. R. Friedlander & Sohn, Berlin W. N., Carlstrasse, 11.
Mr. Ernest Leroux, 28, Rue Bonaparte, Paris.
Mr. Martinus Nijhoff, The Hague, Holland.
Mr. B. H. Blackwell, 50 and 51, Broad Street, Oxford.
Messrs. Deighton Bell & Co., Cambridge.
Mr. Rudolf Haupt, 1, Dorrienstrasse, Leipzig, Germany.
Messrs. Luzac & Co., 46, Great Russell Street, London, W.C.

In India.

Messrs. Thacker, Spink & Co., Calcutta and Simla.
Messrs. Newman & Co., Calcutta.
Messrs. R. Cambray & Co., Calcutta.
Messrs. S. K. Lahiri & Co., Calcutta.
Messrs. B. Banerjee & Co., Calcutta.
Messrs. Higginbotham & Co., Madras.
Messrs. V. Kalyanarama Iyer & Co., Madras.
Messrs. G. A. Natesan & Co., Madras.
Messrs. S. Murphy & Co., Madras.
Messrs. Thompson & Co., Madras.
Messrs. Temple & Co., Madras.
Messrs. Combridge & Co., Madras.
Messrs. P. R. Rama Iyer & Co., Madras.
Messrs. A. R. Pillai & Co., Trivandrum.
Messrs. Thacker & Co., Ld., Bombay.
Messrs. A. J. Combridge & Co., Bombay.
Messrs. D. B. Taraporevala, Sons & Co., Bombay.
Mrs. Radhabai Atmaram Sagoon, Bombay.
Mr. Sunder Pandurang, Bombay.
Messrs. Gopal Narayan & Co., Bombay.
Superintendent, American Baptist Mission Press, Rangoon.
Rai Sahib M. Gulab Singh & Sons, Mufid-i-Am Press, Lahore.
Mr. N. B. Mathur, Superintendent, Nazair Kanun Hind Press, Allahabad.
Messrs. A. Chand & Co., Lahore, Punjab.
Messrs. A. M. & J. Ferguson, Ceylon.
Babu S. C. Talukdar, Proprietor, Students and Company, Cooch Behar.

THE

AGRICULTURAL LEDGER

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INDIAN PENS.

Indian Pens, their history, classification, materials used and methods of manufacture. *By* I. H. BURKILL.

INTRODUCTORY.

It is necessary before discussing native pens to enumerate the materials on which they are or were required to write.

Materials for writing on.

First of all there is the palm leaf; and the ways of writing on it are two, (*i*) by incision with a point with or without rubbing in ink afterwards, and (*ii*) by application of ink to the unbroken surface; secondly, there is paper with its various degrees of finish; and thirdly, the dust-board: the fourth and fifth of writing materials are now out of use; they were birch-bark and heavily sized cotton. The parchment and papyrus of the Mediterranean region do not seem to have been used in India.

Palm-leaf books were the only books of the south until comparatively recent times; birch-bark was the old writing material of the north, heavily sized woven cotton cloth seems to have been used in various places for special purposes: paper came in with the Mughals except into Burma and perhaps into Nepal and the dust-board is the simple calculator of everywhere—a board covered with dust on which the writing or calculation is done, and then soon rubbed out again.

The Musalmans spread paper-making through the Old World.

Paper-making is recorded as an invention of the Chinese in perhaps the second century of the Christian era. Chinese prisoners of war in 751 A.D. introduced its use among the Arabs: they made it in Samarkand, which the Arabs had captured in 704 A.D.: and up to the 11th century that city remained famous for its paper. Bagdad from 794 A.D. onwards stood second to Samarkand as a paper-making centre, and kept its industry up to the 14th century. Damascus became famous for its paper in the 10th century. In the 11th century Cairo came to be known for its paper. Paper-

INTRODUCTORY.

making, after the Chinese had taught the Arabs how to make it, became a notable Muhammadan industry; in spreading its manufacture they have done a vast work in the world: they introduced it into Spain and had good factories there, better than those of the Christians who followed them: they probably introduced it into Sicily: theirs was the paper introduced into Greece. By their efforts paper-making thus entered Europe and displaced the papyrus and the skin-parchments of the ancients.

It is clearly evident that excluding Nepal and Burma the Musalmans introduced paper-making into India as into Europe.

In Akbar's reign its manufacture was commenced in Kashmir and it was encouraged under his successors there and elsewhere, as well as under the Peshwás and other rulers who came into power as the Mughal Empire broke up. Thus it happened that down the western side of India paper became the chief of writing materials, and then its use spread eastwards. Into Burma its use has undoubtedly come direct from China.

It is important to note now that the art of paper-making long before its introduction into India had advanced far enough for the paper to be sized and made smooth. Wiesner has examined many old Asiatic papers and recorded his observations in an essay entitled Mikroskopische Untersuchung alter ostturkestanischer und anderer Asiatischer papiere (Denkschriften Akad. Wien, Mathem-naturw. Cl. LXXII, pp. 583-632): he found that by the 7th century in Turkestan the use had come in of plaster of Paris together with a gelatine made from lichens or of starch-paste.

We need in India to examine some of our oldest preserved papers in order to ascertain their relation to those made north of the Himalaya.

CLASSIFICATION OF PENS.

The pens used by Indians for writing on these various materials fall into six classes:—

(1) the iron style,
(2) the porcupine quill,
(3) the bamboo pen,
(4) the palm mid-rib pen,
(5) the reed and fern pens, and
(6) the quill.

The Chinese domiciled in Calcutta write with their indigenous brush.

The iron style is used only for writing on (incising) palm leaves. The porcupine quill is only used for making calculations

on a dust-board. These two never have slit points for carrying ink and giving flexibility: the other three classes of pen have slit points after the fashion of the European pen, and are flexible. We thus get two very distinct types of pens and the use of both goes back further than history. The one was the Stylus or στῦλος and the other the Arundo or Calamus (κάλαμος) of the Romans and Greeks. The last is the real precursor of the modern pen. CLASSIFICATIONS OF PENS.

The stylus or lekhani of India consists of an iron bodkin often with the upper end weighted by flattening or otherwise, that it may, when it is not actually being pressed down, fall towards the back of the hand of its own accord, raising the point from the surface being incised. THE IRON STYLE.

The Indian Museum possesses a long series of these iron styles, the old specimens all from Orissa, but the new ones chiefly a recent and most excellent gift from the Government of Madras. The simplest form might be considered an imitation in iron of the porcupine's quill: it is an iron rod like a stout knitting needle variously sharp at one end or at times at both. Such styles have all come from the contiguous districts of Vizagapatam, Godaveri, Kurnool, Kistna and Nellore. Shorter, but otherwise similar, rods have come from Godaveri. Short and doubly sharp rods have come from Ganjam and Vizagapatam only. The now generally disused style of Burma, of which Mr. Mackenna, after much trouble kindly taken, has only been able to get me a single specimen, is short like those of Ganjam, but not so sharp though more tapering. Styles of a much heavier type, doubly sharp and very thick in the middle, have been received from the opposite coast of India—from the contiguous districts of South Kanara and Malabar. Styles of a third type are thick and weighted towards one end—the upper end: they have been in use, I believe, in every district of India south of the Godaveri. The weighting is achieved in simple cases by a mere gradual thickening of the stem towards the upper end: but in more elaborate pens we find it achieved by means of a little abrupt globe placed upon the stem just above the middle: styles of this class are in many cases beautifully ornamented with bidri work. They have been received from the districts of Malabar and South Kanara and from the town of Anjengo which stands cut off from Malabar by a strip of Travancore territory; and further one specimen has come from the opposite coast—from Nellore. Similar to the last but brass-topped are styles from the contiguous districts of Kistna and Nellore, and the somewhat remote district of Madura. It is not unnatural that costly pens such as these

THE IRON STYLE.

should travel about the country and so get a dispersal which the ordinary pen does not.

The rest of the types of style consists of a combination of a knife, for cutting the palm leaf, and a point for writing on it. The simplest forms have the upper end of the rod flattened into a blade and sharpened. Out of type 1 above, is thus evolved a style which we may call type four, and out of type 3 type five: types four and five are used in the same parts of India as types one and three respectively, *i.e.*, in the same or contiguous districts: type four is therefore eastern, and type five western and southern. Type four develops in Orissa and Ganjam into a very characteristic form—a style with a broad flat head, one edge of which facing down is for cutting the palm leaf, while towards the other side is an eye-hole for suspending the pen. The Indian Museum possesses a long series of styles of this type. One curious style from Cuddapah has two cutting edges and two eye-holes: others from Anantapur and Kurnool have the two eye-holes but only one cutting edge.

As type six is the clasp-knife, against one side of a wooden or iron handle folds the style, and against the other the knife blade. The wood of the handle is often ebony: the blade sometimes possesses a notch near the apex to enable the thumb to open it; and sometimes a brass stamp for a seal is affixed. This clasp-knife type has been received from almost all of the districts south of Madras. Two kindred types remain to be named, of each of which I have but one specimen. Type seven may be regarded as type four provided at the middle with a wooden sheath which can be folded over the blade or over the style-point, and type eight is an European two-bladed clasp-knife turned into a style by the filing down of one blade. Type seven came from Malabar, and type eight from Salem.

Lastly there is the two-pronged style for describing circles and parallel lines; it is alike at both ends and with a twisted column. Of it specimens have come to me from Salem, South Arcot and Madura.

The style or Ka-nyit of Burma is pointed at both ends. Monks use it still in some small degree. It is no more than a simple rod of iron, both ends of which can be used for writing.

Ink is by no means always used with these styles, and even if used is not carried to the palm leaf by the style, but spread over the surface afterwards, whereupon the broken surface takes it up.

THE IRON STYLE.

It appears probable that the style was the pen used invariably in the extreme south of India before the Portuguese reached the east; and palm leaf-books were there the only books used. With the Portuguese came the use of the quill and the adoption in Tamil of the word 'penna' for an ink-carrying pen.

THE PORCUPINE QUILL.

The porcupine quill needs no manufacture for use. We have in British India four species of porcupine two of which **Hystrix leucura** and **H. bengalensis** have on the flanks between the crest and the tail the straight spines which serve as pens: these spines are few in **H. bengalensis,** and perhaps are very little used. The common porcupine quill of the bazaar of India is the quill of **H. leucura.** The flesh of a porcupine is clean and eaten; but "throw the quills away lest they breed strife," says a Mysore proverb, in allusion to their use for writing.

THE BAMBOO PEN.

Leaving classes 1 and 2 with which we are not very immediately here concerned we proceed to the true pens. The bamboo pen is not so flexible as the reed pen and not well suited for writing curves: the result is that the bamboo is more used in those parts of India where the characters are stiff than in those where they are curved or is avoided for cursive forms of the stiffer scripts. Thus it happens that children are taught to form their letters with the bamboo and thereafter allowed to learn to write a cursive hand with the reed pen. They will write अ क ख ग with the bamboo, but ಒ ತ ಖ ಓ with the reed.

Ornamented bamboo pens are more abundantly sold in Western and Southern India than in Eastern India. They are said to be prepared in China entering India by Bombay and Karachi. Whether Chinese or not they certainly pass through Singapur from somewhere beyond. The bamboos used for them are obviously selected for the length and straightness of the internodes between their joints.

Imported ? Chinese bamboo pen.

I recognise that two species of bamboo furnish them; for of the pens one is grey-green and has been in all cases ornamented with oval spots while the other is chestnut-brown ornamented with cloudy blotches or lines of dots. My specimens of the first have been bought in the bazaars of Madras, Bombay, Nágpur and Delhi; while my specimens of the second have been bought in those of Madras, Hyderábád, Nágpur, Akot (Berár) and Narsingpur. It will be noticed at once that these pens find a fairly wide market. The first named pen seems to be sold with invariably one, sometimes two, nodes on the length, while the second generally has

THE BAMBOO PEN.

none. The second has a larger lumen than the first and is generally a little stouter.

I should say that they probably come from different places: the size and the way in which they have been treated suggests this.

I have further received from Nágpur a single pen dyed red (with eosin apparently) which seems to have come from the same kind of bamboo as the second of those just described. I assume that it is also of Chinese origin.

What bamboos are the sources of these pens I cannot say. There is no literature known to me.

Bamboo pens of Indian origin.

I now pass on to bamboo pens of Indian origin. I shall take them in two groups, (*i*) the solid pens made from strips of bamboo stems and (*ii*) the hollow pens, like the imported Chinese pens made of bamboo branches.

Bengal is the chief place where the bamboo pen is employed. Its use is customary with certain classes of people: astrologers (achcharyas) for instance use the bamboo-splint pen as a part of the ceremonial of casting horoscopes, and Hindu pandits affect it somewhat. School boys and ordinary country folk use the pen of a bamboo joint commonly called *Kanchi*, or as pronounced in Bengali *Konchi*. The use of both kinds of pens is, indeed, general among the Bengalis. The stems or branches required are cut green and often seasoned by being immersed in water or put into mud, for a fortnight or more. Exactly what process this seasoning implies has not been worked out, but the pen is said to be harder, *i.e.*, to keep its point better from it: and indeed bamboos for other purposes are seasoned by immersion in water. Bamboos after immersion are said to be less subject to insect attacks than if not immersed, because the water has withdrawn the sap from them; but bamboo pens would hardly be liable to insect attacks and the seasoning in water would seem to have the other use of hardening them.

Beyond the confines of Bengal the use of bamboo-splint pens extends. I have received them from the Nepál hills, Yeotmál in the Central Provinces and South Kánara. In Bengal the strips of bamboo are often shaped carefully to be thickest where the fingers grip, and to taper to the upper end. My samples from Yeotmál and South Kánara show none of this: they are indeed crude. To make the point, the inner part of the bamboo is cut away and the point itself is split as is a quill. The actual writing is thus done with the outer part of the wood which is the hardest. The bamboo

THE BAMBOO PEN.

used is probably in most instances from one of the more common species of *Bambusa*.

The bamboo branches which serve in Bengal do not possess long internodes like those of the ornamented imported pens described first, and the pens are of necessity only about five to six inches long. The lumen is small and without being artificially enlarged hardly comes near enough to the point, when cut, to serve as a reservoir for ink. It seems possible that **Bambusa arundinacea** is the chief source of these pens; and, as it grows very generally throughout Bengal, the local demand is locally satisfied.

Bambusa vulgaris is probably also used: it—the Bariala bamboo—is said to be used in Chittagong.

Dendrocalamus strictus seems to be put under contribution at Chindwara in the Central Provinces.

Ochlandra Rheedii and **O. travancorica** are reported to me as used in Tinnevelli, and the former in Mysore.

What is certainly a species of **Arundinaria** is used for making pens in the Nágá hills. It has reached me under the name of *Jili bans* and is perhaps **Arundinaria Prainii.**

A pen with a large lumen from Multán is, I suspect, from **Dendrocalamus strictus.**

Another **Arundinaria** which furnishes pens about Darjeeling is **A. racemosa,** locally called *Malingo;* but is apparently only one of three bamboos there put under contribution. A second received under the vernacular name of *Khapteri* is a bamboo of the lower hills of Sikkim which I cannot name. *Deo Nigali* is the third, and is also an **Arundinaria.** *Nigala* is said by Gamble to be a name of **A. intermedia,** *Munro;* but *Deo Nigali* is an **Arundinaria** of greater elevation. I have made an attempt to collect *Deo Nigali* in the Darjeeling District but without success, though I looked for it all along the Singlela ridge up to 12,000 feet, and elsewhere at lower elevations.

I found to be sold in Khátmándu a very hard little bamboo pen with a small lumen: its origin I cannot determine.

PALM MID-RIB PENS.

We leave bamboo pens and proceed to palm mid-rib pens.

These are inferior to the bamboo in serviceableness: they are made from the mid-rib of the sago palm **(Caryota urens)** in Southern India. I have received specimens from Anantápur and South Kánara in Madras and from Poona in Bombay. It is reported to me by Mr. G. A. Gammie that they are used in the Haveri Taluka of the Dhárwár District. Bagani galaga or simply Bagani is the name

PALM MID-RIB PEN.

given to them about Anantápur, Dhárwár. From some of the pens the epidermis has been scraped; on others it has been left. The point is made from the outer tissues on the ventral—rounded—side of the mid-rib.

REED PEN.

Of the reeds many species are used. In my collection I have reed-pens derived from:—

Hollow.
- **Saccharum fuscum.**
- **Phragmites Karka.**
- **Phragmites communis.**
- **Arundo Donax.**
- **Triraphis madagascariensis.**

Solid.
- **Saccharum arundinaceum.**
- **Saccharum spontaneum.**
- **Sorghum halepense.**
- **Sorghum vulgare.**
- **Pennisetum typhoideum.**

Saccharum fuscum.

Out of all the reeds **Saccharum fuscum,** noteworthy in its genus for its hollow stem, is apparently that which makes the best of reed-pens. The grass is reported to grow at Disful in Persia plentifully and the pens are thence imported into India by Bombay. It also grows in wet places in Eastern Bengal, and receives some small degree of cultivation; that is to say, it may be purposely planted and protected until it has grown up, when the stem is cut, with the leaves and the leaf-sheaths stripped off; and it is sold in lengths of several feet or cut into lengths of one or two internodes. It grows also, and is used for pen-making on the banks of the Godávari and Kistna in the Madras Presidency: and to some extent it is collected locally in the Circárs. It is reported in various places that the Nepál Terái furnishes some of the pens, but at any rate it does not furnish many. One may know the reed by its deep brown colour, which, where the sun has not touched it, shades off to a dull straw colour. To ornament these pens before sale is unusual, but is sometimes practised by twining threads round them in spirals and then scorching them.

Such pens have been received only from the Central Provinces and Saháranpur.

Rarely, nature by means of some climber makes similar marks up the growing reed, the creeper preventing the sun from causing the stems to go brown.

Pens of this reed are extensively used all over the Bengals, through literate Assam, fairly generally through the peninsula of

India to the very south and westwards through the United Provinces to the Punjáb. They also reach Burma. Arabic and Persian characters are generally written with them; and Musalman immigrants have carried their use to the very south of India into a country where the Hindu population uses no such pen. They are also used for writing Nágari characters, particularly as stated above the more cursive forms. PALM MID-RIB PEN.

The reed is extensively named among the Bengalis Khag or Khagra, rarely Khagri, sometimes it is called Sar or Shar. A pen of Sar becomes Sar Katti or Sharkatti, or if the word 'Khagra' is used, Khagra Kalam.

Among the Hindi and Urdu speaking people we get the words Wasti, Owasti and Oasti with less common variants around, *e.g.*, Asthi (Monghyr), Osthir (Murshidábád), Owastir (Bánkurá), Ozastri (Midnapur), Wastir (Ghátál and Delhi, etc.). The use of Wasti extends into the Assam hills.

In Bombay, the Punjáb and the Central Provinces the general name is Kilak, a Persian word for a pen. In Patná and Muzaffarpur the name is also used in the form Killik; and the Chutia Nágpur, it is corrupted to Killi.

The word Wasti has been explained to me by a correspondent as derived from Wasit, a town in Persia. This name and the use of the Persian word Kilak, and in the Punjáb of the name Irani Kalam point to the origin of the pen and also suggest that its use in India is not ancient. It is said to be imported through Singapur also.

I now give two reports kindly obtained for me from Persia. In both reports one origin for the pens is given, *viz.*, Dizful. The connection of the pen with the town of Wasit has not been cleared up: it will be noticed that Major Ducat says that my supposition that Wasit is Gwasht is incorrect: there is, he says, no pen industry at Gwasht.

Note on the Cultivation and Produce of the Pen Reed (Qalam) in the Dizful District, by Captain D. L. R. Lorimer, His Majesty's Consul at Ahwaz, dated 14th March 1909.

The site of cultivation is the low lying ground along the course of the Diz river extending for some miles from a point three or four miles below the town of Dizful. The soil must consist solely of mud without any admixture of sand or gravel. Mode of cultivation.

Mode of cultivation.

The ground is prepared by a rough ploughing or hoeing and the preparation of water channels at short intervals. The channels are about $1\frac{1}{2}'$ deep and must always contain water.

REED PEN.

When the ground has been thus prepared roots (risha) of the reed are then planted out, and are left to grow and mature for three years. After these three years they are transplanted to similarly prepared ground. Thereafter they begin to yield reeds of commercial value as follows:—

In the 1st year *nil.*
In the 2nd year reeds suitable only for the Persian market.
In the 3rd year reeds suitable for the Persian market and a small quantity for export.
In the 4th year reeds suitable for Indian market.
In the 5th year ditto.
In the 6th year ditto.
In the 7th year reeds suitable for Indian market, and other foreign markets.

The produce of the 7th year is better in quality than that of any other year. The full life of the reed is said to be 16 years.

Preparation for the market.

When ready for cutting the reeds are stripped of all green leaves and sheaths. Their colour is then "white," which changes to the characteristic chocolate colour by exposure.

When this change has taken place they are cut and placed in store rooms from which fresh air is carefully excluded. Here they are allowed to dry and "sweat" for 40 days, after which they are taken out, graded, and disposed of.

Commercial differentiations of the reed.

The following types or qualities, all being obtained from the same plant, are recognised:—

1st Quality.—Qalam-i-Banyani, especially in demand in the Indian market.
These are thick well-developed reeds, well consolidated, and with long internodes (*qab*).
The local average price is Krans 4 per *dastah* of 100 (entire) reeds.

2nd Quality.—Qalam-i-Ablaq, a reed of inferior quality to the Banyani. It is described as more "sust," *i.e.*, slack, or less well consolidated. It is both exported and used locally, but is not in favour with Persians.
Average local price Krans 2 per *dastah.*

3rd Quality and 4th Quality.—Qalam-i-Amiri and Qalam-i-Mirzai. These are thinner than the preceding types,

but are well formed and are those in general demand in Persia where they are preferred to others. The two kinds vary apparently only in dimensions, the "Amiri" being slightly larger than the "Mirzai." REED PEN.

Prices vary much, but the average price is given as 1 to 1½ Krans per *dastah*.

These kinds are referred to from a commercial point of view as "Bab-i-Iran," the Banyani being "Bab-i-Hind." Trade and export.

The reeds vary in length from about six or seven feet to about 4 feet, in the case of some of the "Mirzai."

It is denied that in this district the reeds are cut before reaching maturity.

The value of reeds produced in the Dizful district is said to be liable to extreme fluctuation, the annual value varying between 5,000 and 100,000 Krans (the ordinary range of the value of the Kran being from 340 to 380 Krans per Rs. 100 = £6 13*s*. 4*d*.).

Within Persia, Dizful furnishes reeds to Hamadan, Ispahan, Shiraz, and probably Bushire.

Export is principally to India and *viâ* Bombay to Egypt, Constantinople and China.

The pen reed is said to be also found at Badrai on the Turko-Pusht-i-Kuh Frontier, and at Qal'a Tul in the Bakhtiari country, but the quality is inferior.

The flower of the reed is said to be useless, and propagation is wholly by division and planting out of the root.

Specimens of the flower will be obtained if possible. Specimens of the "Ablaq," "Amiri" and "Mirzai" types of reeds are forwarded with this report. Owing to the disturbed state of the country all commercial intercourse with Dizful has for some time been cut off, and specimens of the "Banyani" reeds are not at the moment obtainable here.

No. 15—109, dated the 15th April 1909.

From—Major C. T. Ducat, His Britannic Majesty's Consul, Kerman,
To—Major P. Z. Cox, C.I.E., Political Resident in the Persian Gulf.

With reference to your endorsement No. 23/535, dated 28th February 1909, enclosing copy of Government of India's letter No. 244-F.A., of the 16th February 1909, with its enclosures, I have the honour to inform you that my information is that the chief source of "Kilk or Irani Qalam" which furnishes the native pens is a dense jungle of reeds in the vicinity of Disful between the

REED PEN. provinces of Khusistan, Luristan and Bakhtiari whence a large supply is said to be obtained every year and exported to Persian and Indian ports.

Kerman itself receives its supply from Bunder Abbas and possesses no reed jungle in its own district. Nasrullah Khan has been to the place —Gwasht—mentioned by Mr. Burkill and says there was no reed marsh there or any industry such as he mentions.

With Mr. Lorimer's report Major P. L. Cox forwarded to me excellent specimens of the reeds. The diameters of the different kinds are found to be as follows:—

Baniani	·275—·350 in.
Ablak	·225—·275 „
Amiri	·225—·275 „
Mirzai	·175—·250 „

This pen despite the fact that ninety cer cent. of the specimens in the country are of exotic origin is that which is commonly worshipped at the feast of Sri Panchámi by the literate of Bengal. As many pens are bought or brought for worship as there are males in the family and he who earns his living by writing must abstain from using (making a servant of) his pens on the feast day.

In parts of Assam these pens are only on sale about the feast time, Calcutta being the centre from which they are procured. Calcutta is naturally the main distributing centre for the North-East of India, and Bhagalpur serves as a subsidiary distributing centre for Western Bengal. In Orissa pens are worshipped n other feasts besides Sri Panchámi, *e.g.*, Durgá Pujás and Ganesh Chaturthi. In North-Western India, Delhi is a great distributing centre, whence this and other pens travel to all parts: and Bombay, the port at which they mostly arrive, distributes them through the peninsula of India.

It is unfortunate that I have no absolute proof that **Saccharum fuscum** grows in Persia. It is not mentioned by Boissier in his great *Flora Orientalis* nor by any later writers: but I believe that my identification made without flowers is quite correct.

accharum pontaneum. Next to **Saccharum fuscum** in wideness of its use among the species of that genus, comes **Saccharum spontaneum,** a very common reed of most parts of India. It is turned into pens all over the Bengals by villagers, and again in most parts of the United Provinces, in many parts of the Punjáb and somewhat in Southern India. Its inferiority is recognised and it is now rarely brought

into the market for pen-making, though used extensively for fence-making, and as a binder in making mud walls. Delhi is one of the very few places where the reeds appear in the bazaar cut for pens: they are cut in double lengths enough for two pens. For pen-making only the very best grown of the reeds of this species are suitable. REED PEN.

Bákarganj, Jessore, Faridpur and neighbouring districts would seem to be those where the pen is much used: school boys learning to write particularly use it. Up the Brahmaputra Valley and the Ganges Valley, the use is not infrequent, the pens being sought just as required. Pilibhít, Moradábád and Bareilly supply Delhi with the reeds that are there sold. Reeds are locally cut just as pens are wanted in Southern India.

Saccharum spontaneum does not make such a clean looking pen as either the last or the next: for its stem is a dirty straw colour often blotched with red.

It is solid in most cases: and when hollow the lumen is very small and irregular.

A glance at our Floras will show how variable this grass is in stature: thus Hooker (*Flora of British India*, VII., p. 119) and Prain (*Bengal Plants*, p. 1188) say that it varies between 5—20 feet high. No wonder then that the pens from it vary in size. I have specimens in diameter ·4 in. (10 millimetres) and others only ·16 in. (4 millimetres).

The very thin specimens come from Anantápur and South Kánara in the Madras Presidency. The little stems are harder than the larger ones and perhaps specially chosen, just as the little hard stems of **S. fuscum** are preferred in Persia.

Like **S. fuscum** this reed is very commonly called *Khagra*, *Khagar*, *Khagara* or *Khagari* in Bengal. The use of Khagari extends to Sibságar. Towards Western Bengal the name varies to *Karia* (Rámpur Beauleah), *Kharai* (Rájmehál), *Khari* (Monghyr), and *Keshi* (Pakur), and *Keshia* (Bardwán). In North-Western Bengal the name *Kanda* is applied to it as to **Saccharum arundinaceum** and *Ikri* or *Inkri* is not uncommonly used in Tirhut.

Darbha, *Darbe* and *Dherbai* are the names used in Bellary, Mysore and the country southwards and also in Nellore and Anantápur eastwards. A few other local names have reached me attached to pens, *Pakri* is one coming from Vishnupur in the Bankura District, *Bon* is another used in Rájsháhí: *Garhan* or *Garahan* one from Muzaffarpur: *Dhour* and *Salendi* are two other

REED PEN.

names used in the Bahraich District where reeds are cut and graded by the weavers who require them.

From Madras, pens of **Saccharum spontaneum** have reached me in greater numbers than those of any other **Saccharum.** The immigrant Márwáris, who are those who use such pens, seem to find it serviceable for writing in Nágari characters.

Saccharum arundinaceum.

Saccharum arundinaceum is used for pens locally, chiefly in the Ganges Valley, the country of the Munj grass (**Saccharum arundinaceum,** *var.* **ciliare).** It is called *Sar*, *Shar* or *Shari*, and also, like **Saccharum spontaneum,** *Kanda.* At Gayá the word *Sar* is changed into *Sarka* or *Sirki.* It is also used a little in the peninsula of India as I have received specimens from Parlakimedi in the Ganjám District, Biláspur, Drúg and Malabar. The Parlakimedi specimens are labelled *Jayakana*, the Biláspur specimens *Kandsar* and the Malabar specimens *Chengamai.* I have received it under the name of *Kana* from Amritsar and Múltán.

Saccharum arundinaceum is apparently used in Cuddapah for pens. I have received thence a bundle of stems, the thickest ·8 in. (2 cms.) thick, under the name of *Veri cheruku.*

The stem of this grass is very pale in colour: it is solid and the central tissue soft and rather absorbent. It cannot be said to make good pens.

Sorghum halepense.

Sorghum halepense is almost the chief source of country pens on the western part of the plateau of the peninsula of India. It gives solid pens very similar to those given by **Saccharum arundinaceum,** *var.* **ciliare.** As a rule they are darker in colour and slightly heavier. As far as I know they are never sold in long lengths.

The grass is very well known as *Baru* or *Bharu*, and sometimes distinguished as white *Baru* or *Tandch baru* or in Western Bengal as *Bharuhi.* From Dumká it has reached me under the wrong name of *Kharai.* Arrah, Gayá, Dumká, Ránchi and Palámau are the most eastern places from which this pen has come to me.

To get good pens it is necessary to grow them purposely. The grass begins to grow vigorously in June and flowers in October. Just before it would flower the stems must be topped and left to grow again. Four months later, when a second flowering would occur, they may be cut for pens. Pens are thus locally prepared in most parts of the Central Provinces; but there is a very little trade in them. They are the pens there chiefly worshipped at the feast of Sri Panchámi.

REED PEN.

Sorghum vulgare, the great millet, is occasionally put under contribution for furnishing pens. Pens from it have been received from the Central Provinces, Bombay and Madras only. A man only cuts a pen from this plant when the more regular pen-furnishing grasses are not to hand. Sorghum vulgare.

Pennisetum typhoideum, the Bulrush millet or Bajra, makes very inferior pens and is only rarely used. I have received it from Patná and Bahramghát in the United Provinces. Like **Sorghum** it is but used when other pen-furnishing grasses are not to hand. Pennisetum typhoideum.

Phragmites communis and **P. Karka** furnish very brittle light hollow pens which are pale straw coloured or greenish. The second is the more important source. Phragmites communis and P. Karka.

Often the pens from this reed are of considerable diameter: I have them up to ·8 in. (20 mms.) across: but it is evident that they are preferred of smaller more ordinary dimensions.

They are very largely used in the Madras Presidency where the reed is called *Kakive daru* or *Vel Kantattai* or *Koraka Kantattai* or at Anantápur *Burrakaddi*. I have further received a few specimens from Manipur and Cachar from Western Bengal, from Múltán in the Punjáb, from Bombay, from Hinganghát in the Central Provinces, and one from Lower Bengal and one from Burma.

The reed is known as *Nal* or *Narri* in Northern India: it came to me as *Endow* from Manipur, and as *Narkal* from Muzaffarpur.

One of my pens from this reed has been cut from a particularly large specimen and is only a splint from one side.

Reeds which I found to be used at Khátmándu for pens I believe to be derived from **Phragmites communis.** They were sold under the name of Sar.

Arundo Donax furnishes a pen very like that from **Phragmites,** but is used much less frequently. The pen is a little stronger than that of **Phragmites.** I have received specimens from Nowgong in Assam, Yeotmál in the Central Provinces and Madras and Gudur in Southern India. The reed bears the same name in Madras as the last. In Nowgong it is called *Ekra*. Arundo Donax.

Triraphis madagascariensis (Neyraudia madagascariensis) is believed to be the source of a pen received from Dacca. It is a thin hard pen and is named *Kassi* and *Kasha*.

Hard fern petioles make very fair pens and have probably long been used in North-Eastern India for the purpose, first from indigenous supplies and later by import. They are used in the West of India in the finest writing "Khush Khatt" because they keep such a good point. Fern pens.

REED PEN.

The numbers of fern petioles imported into Calcutta must be considerable; they come from Penang and Singapur; and possibly a large part of them reach Singapur from Java. They are the bright brown very hard stem-like leaf-stalks with a loose core and flattened on one side which one sees so plentifully in every bazaar of Bengal. The flattened side is the upper side of the fern leaf-stalk, and the loose core the vascular bundles which in drying and with the help of decomposition have become freed from the hard outer strengthening tissue. The fern which supplies the imported pens is **Cleichenia linearis.** To Mr. J. B. Carruthers of the Department of Agriculture, Federated Malay States, I owe the specimens whereby I have identified it.

Cleichenia linearis.

The collections of pens that I have made and that have been made for me in the course of this enquiry include more examples of pen from **Cleichenia** than from any other plant. Up and down Lower Bengal and in Orissa the name *Kalmi Kalam* or simply *Kalmi* is commonly applied to it: in Upper Bengal about Patná, Gayá, Arrah, etc., it is called *Latar* and this word north of the Ganges in Tirhút becomes *Lati* or sometimes *Kalam Lati*. In Eastern Bengal it is *Lata* or *Lat* or *Latakati*. In Assam the local vernacular of the fern, which grows there freely enough, is applied to the pen and we have the name *Dhekia* or *Dheki;* but from Goálpárá and Mymensingh the name *Palang* or *Palai* comes. In Chutiá Nágpur apparently various names are applied to the pen: *Dalchini* is used at Hazáribágh; *Darchini Katal* at Ránchi, *Santhi* among the Santáls at Dumká and in Singbhúm it is reported to be variously called *Somti*, *Umesti* and *Killich*. The second of these three names, which is connected with Wasti, and the third do not really belong to the fern; but belong to the Persian reed-pen from **Saccharum fuscum.** Through the Central Provinces the fern is called *Bed Muska* or *Mushk beda*.

In Madras it is called *Koruka thattai* in Tamil, or at times *Java Kacan*.

This imported fern pen gets a good deal broken up on the voyage, so that from Delhi it is reported that 25 per cent. of the pieces received are useless. However it obviously pays to import it, the indigenous fern pens which might compete with it being so inferior.

Cleichenia linearis is a very widespread tropical fern which ascends the mountains of Southern India to 6,000 feet and the Himálaya to 5,000 feet. *Dhenki* or *Dhekia* as already stated is its Assamese name, and has largely passed in common parlance

to the imported pen; *Palai* is its Nágá name, *Kameng* its Manipuri name. It is probably the fern called *Chyakun*, *i.e.*, iron fern, by the Bhutias and is called *Poomol Boisong:* by the Lepchas it is called *Hari onea*, *i.e.*, black fern. Pens are made of it in the Darjeeling District. REED PEN

In many parts of Assam school boys make for themselves pens of the wild *Dhekia*, and so also is done in Manipur, but to the best of my knowledge the fern does not grow there large enough to be fully serviceable;—hence the way in which imported stems hold the market against them in the Bengal plains. The Bengalis do not generally know the origin of the fern-pens that they use; they fancy that they are locally produced by some unknown process from the runners of **Ipomœa aquatica,** a soft water plant commonly eaten as a vegetable under the name of Kalmi ság. The dealers in them in Calcutta are men in a very small way of business.

Nephrodium boryanum furnishes pens at Kohima in the Nágá hills and is called *Dhekia* like the last. It is a large fern. Nephrodium boryanum.

I have one small intensely hard fern-pen from Madura imported from Singapur, the source of which I cannot name.

We now come to the quills; they are chiefly peacocks' feathers—the black and the brown wing feathers, and sometimes the tail feathers. The brown wing feathers seem to be commonest, and almost the only ones used in Northern India. My samples of the black wing feathers come from Madura and of the tail feathers from Bellary. QUILLS.

White goose quills from the wing are used in Bengal and Assam alongside the brown peacock wing quills. They do not come up in quality to the best picked European goose quills, but are apparently imported. They are weaker than the peacock wing quills. Goose quills.

Now quills used in Europe should be carefully picked: they are not really good if taken from fatted killed geese, but only if taken from living geese in good condition.

Ten wing feathers are plucked from each goose and they fall into four grades:—

best, the second and third of the left wing,
second best, the first, fourth and fifth of the left wing,
good, the second and third of the right wing,
worst, the first, fourth and fifth of the right wing.

The second and third feathers are the strongest. The feathers of the right wing are not so good as the feathers of the left wing

QUILL. owing to the fact that in the hand of the writer they curve towards his face and may be inconvenient. After plucking they are heated in sand and undergo while hot a scraping to clean them. The heating if well done leaves them very elastic.

My examples of goose quills from Indian bazaars are all left wing feathers: all have been cut short just above the middle, and all have been scraped. They are all smaller than the best selected European quills and less firm.

Peacock quills. My peacock feather quills are by no means all left wing feathers and I believe that they are all cast feathers, picked up in the jungle about the moulting season which is September in Northern India, and in Southern India October to December.

A pea-fowl usually possesses in each wing 9—11 stout black feathers and 7—9 brown.

Calcutta serves as a distributing centre for Bengal, probably receiving its supply from several sources.

THE STEEL NIB. Nearly seventy years ago the modern steel pen was evolved in Britain and began to displace the quill. In 1818 an inventor named Joseph Bramah devised and patented a machine for cutting up the barrel of a feather into three or four pieces, which were then pointed as quills are pointed and fixed to a handle. A few years before this a Mr. Wise had folded a tube of steel into a similar form the slit of the pen being formed from the free edges. These nibs were the forerunners of the common nib of to-day, but when about 1840 the industry arose a very great deal of work had still to be done before flexibility was attained. However improvements were rapidly made and the industry which began in Britain has remained very largely British.

Attempts have been made in Bengal at nib-making but no perfection attained yet. Barisál produced these nibs: they were very inferior, crookedly cut, cross-pointed articles. If they are to hold any position their manufacture must be greatly improved. The steel sheets must have been imported in the first instance and no more than the cutting done in India.

THE CHINESE BRUSH. Last of all remains to be mentioned the Chinese brush. Chinamen in India use it always. They import it from China, and sell it in the Tiretta bazaar, Calcutta, and elsewhere. The best brushes are said to be made of marten hair, inferior brushes of the hair of other animals. The hairs are well packed into a handle of bamboo, or of some **Arundo** or of a similar grass: they are glued together into a cone so that a point is produced with only a very short length of hair free at the tip. Over the cone when not in use fits a thimble

made of a bit of perhaps **Phragmites Karka** or of bamboo. With these brushes the Chinese can make the finest lines. THE CHINESE BRUSH.

SUMMARY. I started this ledger with a note on the material written on: and then proceeded to enumerate all the pens used in India ending with the Chinese brush. The hardness and smoothness of the surface of the first is correlated to the hardness of the pen or brush used. The Chinaman writes with his flexible brush with ease on the roughest of surfaces: the unyielding porcupine quill is only useful for the hard dust-board: and the iron style for the palm leaf. It seems that the Portuguese introduced the use of the bird-quill into Southern India: and they must have brought paper into the country at the same time. The Portuguese of course well knew the art of paper-making, but there is known to me no evidence showing that they introduced paper-making. It would be most interesting to know on what writing material the Portuguese kept their first records in India.

It seems probable that the Persian pen from **Saccharum fuscum** came into wide use with the Mughals and their spread of paper-making. The fern pen perhaps spread in use in India later and from the east side. Bamboo pens have probably been long used; but the importation of bamboo pens from China is of recent origin.

The customs in pens are changing rapidly. Already the Persian pen is only of importance as a religious emblem among a large part of the literate of Bengal: and in most parts of India it is rapidly going out of use. The quill has recently spread in use but may be expected to give place to the steel pen. Burma, the part of the Indian Empire most quick to change, has almost given up pens other than the steel nib. There all men are literate. If India as a whole becomes literate, these native pens as pens will disappear.

A list of all the plants used for making pens.

1. **Arundinaria Prainii,** *Gamble*, p. 117.
2. ,, **racemosa,** *Munro*, p. 117.
3. ,, **sp.** p. 117.
4. **Arundo Donax,** *Linn.*, p. 118, 125.
5. **Bambusa arundinacea,** *Willd.*, p. 117.
6. ,, **vulgaris,** *Schrad.*, p. 117.
7. **Caryota urens,** *Linn.*, p. 117.
8. **Dendrocalamus strictus,** *Nees.*, p. 117.
9. **Gleichenia linearis,** *Bedd.*, p. 126.

10. **Nephrodium boryanum,** *Hook. et Baker,* p. 127.

Neyrandia madagascariensis, Hook. f. see *Triraphis.*

11. **Ochlandra Rheedii,** *Benth.,* p. 117.
12. „ **travancorica,** Benth., p. 117.
13. **Pennisetum typhoideum,** *Rich.,* p. 118, 125.
14. **Pragmites communis,** *Trin.,* p. 118, 125.
15. „ **Karka,** *Trin.,* p. 118, 125.
16. **Saccharum arundinaceum,** *Retz.,* p. 118, 123.
17. „ **fuscum,** *Roxb.,* p. 118, 122, 126.
18. „ **spontaneum,** *Linn.,* p. 118, 122.
19. **Sorghum halepense,** *Wall.,* p. 118, 124.
20. „ **vulgare,** *Pers.,* p. 118, 125.
21. **Triraphis madagascariensis,** *R. Br.,* p. 118, 125.

Other organic materials.

Quills of the porcupine, **Hystrix bengalensis,** *Blyth,* p. 115.
„ „ „ **leucura,** *Sykes,* p. 115.
„ the peacock, **Pavo cristatus,** *Linn.,* p. 127.
„ the goose, **Anser sp.** p. 127.

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THE

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1908-09—No. 7.

CROTALARIA JUNCEA.

(PAPERS ON SAN HEMP IN THE PABNA DISTRICT.)

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1. *Report on San Hemp in the Pábná District by* BABU UMA CHARAN PAL.
2. *Valuations of San Hemp from the Pábná District by* MESSRS. J. N. CHUNDER AND J. FERGUSON.
3. *Chemical examination and valuations in London of other samples of San Hemp from the same sources, communicated by* PROFESSOR WYNDHAM R. DUNSTAN.

INTRODUCTORY.

In March last, under the instructions from Mr. I. H. Burkill, Officiating Reporter on Economic Products to the Government of India, I went to the Pábná District to collect information about the state of the *san* hemp industry of the district. I visited all the important centres of the industry, and the following report gives details of the cultivation, methods of preparation of the fibre as pursued in different places and the way in which the fibre is disposed of from the district.

LOCALITY.

In the district of Pábná, *san* is chiefly grown in the Sháhzádpur and Ullápárá thánás (both in the Serájganj sub-division), the latter being the largest *san*-producing tract in the district. It is also grown to a certain extent in villages under the jurisdictions of Ráiganj (Serájganj sub-division) and Dulái (Sadar sub-division) police stations, but the quantities produced there are not of much importance.

SOIL, etc.

San can be grown in any land where jute or rice can be grown. But as water for steeping is of the greatest necessity, especially during the latter part of the cold weather, it is chiefly grown near rivers or *bils* (swamps) which do not dry during this part of the year.

VARIETIES.

Two kinds of *san* are grown in the district: *Boran* and *Chotna*. The *Boran* variety is grown for fibre. The *Chotna* is not grown for fibre but is ploughed in or cut when green and left on the field

to serve the purpose of manuring which is the chief object for which this variety is grown. Often the cattle are turned into the field to eat the green leaves and twigs of the plant.

NECESSITY OF *SAN* CULTIVATION.

The cultivation of *san* of both varieties is considered necessary in order to enhance the fertility of the soil before jute or rice is grown. And generally when jute is to be grown *san* is the previous crop. In such cases there is always a greater outturn of jute than otherwise. With *san* as a previous crop, the outturn of jute per bigha (·33 acre) is from 7—8 maunds (576—658 lbs.), but without *san* this outturn falls down to 3—5 maunds (247—411 lbs.). From one field two crops are obtainable: *San* or any other crop, such as gram, sarson, etc., and jute or rice. *San* precedes both jute and rice. It is sown in Kartik (October-November) and harvested in Magh (January-February). Jute and rice are sown in Falgoon-Chaitra (March-April). As stated above the fertility of the soil is increased by growing *san* in a field, and jute or rice grown in such lands give a higher rate of outturn. But generally jute is preferred to be the crop after *san*, as jute is considered more profitable than rice. *San* is not, however, grown in the same field continually for more than two or three years. Because, if successively grown year after year, the outturn of the *san* crop becomes poor and the general practice to remedy this is to raise *san* for two or three years and then gram or sarson takes its place to precede jute or rice.

SAN AS GREEN-MANURE FOR JUTE AND RICE.

OUTTURN OF JUTE WITH *SAN* AS A PREVIOUS CROP.

METHOD OF CULTIVATION.

The method of growing *san* is very simple and is almost similar in various places of the district. Two or three ploughings are given in the field and the seed is sown and the field laddered. No hoeing nor weeding is necessary. The method is described in detail under Sháhzádpur.

AREA AND PRODUCTION.

The area under *san* in the Pábná District (almost entirely in the Serájganj sub-division) may be estimated at about 80,000 bighas or approximately 27,000 acres. The total annual production may be said to be about 130,000 maunds (4,758 tons); at any rate it cannot be more than 150,000 maunds (5,490 tons). This estimate of production is based on the information obtained from local dealers in the fibre as well as the cultivators, and is calculated as follows:—

	Mds.
Ullápárá	75,000
Sháhzádpur	45,000
Ráiganj and Dulái, etc. . . .	10,000
Total .	130,000

AREA AND PRODUCTION

According to the rate of production per bigha the area producing this quantity, *viz.*, 130,000 maunds of *san* fibre, would be approximately 40,000 bighas. It is to be understood that this area is for the *Boran* variety only and if we add as much for the *Chotna* variety, the total area under the *san* crop would come to about 80,000 bighas or approximately 27,000 acres.* It may also be mentioned here that in the northern part of the district the area sown with the *Chotna* variety is comparatively larger than that sown with the *Boran* variety.

EXPORT AND LOCAL CONSUMPTION.

Almost the entire production of the district is exported. A small portion, however, is consumed locally, being used for fishing nets, gunnies, and cordage and ropes, especially for towing boats against stream, such ropes being known as *goons*. It is stated at Ullápárá that native merchants chiefly from Dacca, known as the *Gooniahs* (*i.e.*, dealers in, or manufacturers of, *goons*) come in during the season to purchase the fibre which they carry to their native place where the stuff is made into *goons* or other kinds of ropes.

Sháhzádpur.

SHAHZADPUR. CULTIVATION Extent.

The *san*-producing tract within the Sháhzádpur tháná is bounded on the east by the river Jamuná, on the south by the river Borul where it joins the Huráságar (or Oráságar). If a line is drawn through Sháhzádpur town to the town of Ullápárá, about 12 miles to the north, it is almost the western boundary of the *san*-producing tract in the Sháhzádpur tháná. On the north comes the Ullápárá tháná which is the largest *san*-producing tract in the whole district.

Markets.

In the Sháhzádpur tháná the chief markets for *san* fibre are Káijuri (on the Huráságar), Belkuchi, Khidirkol, Pangási, and Porabári (on the Jamuná). Betkandi, Bhaka, Sarotia (near Serájganj) and Tálgáchi. Of these Káijuri is the most important centre of *san* trade in this tháná.

Variety grown.

The variety grown in the Sháhzádpur tháná is chiefly *Boran*—the variety grown for fibre only. The *Chotna* variety which is solely grown for green-manuring is also sown in places to the east of Sháhzádpur town.

Method of growing. Sowing.

San is sown in Kartik (October-November) when the soil still holds moisture in it. Two ploughings are necessary before the

* This estimate of area is somewhat below that made by the Sub-Divisional Officer of Serájganj, as published in the Forecast of Rabi Crops in Eastern Bengal for 1908-09. The Director of Agriculture says: "The only estimate regarding which any definite report has been received is the *san* hemp. The Sub-Divisional Officer of Serájganj estimates that the area cropped this year in that sub-division is 30,000 acres, against a normal of 29,000."

SHAHZADPUR. CULTIVATION. seed is sown. After sowing the seed a third ploughing is given. The next treatment is laddering and the operation is complete.

Seed. Quantity required per bigha Price. For a bigha (·33 acre) of land about ½ maund (katcha weight, a seer = 60 tolas) of seed is required. The usual price of a maund of seed is from Rs. 6 to Rs. 8 (8*s*. to 10*s*. 8*d*.). But the price of the seed this year was abnormally high and was from Rs. 10 to Rs. 14 per maund. The seed is imported from Prasádpur (in Rájsháhi district), Purnea and Maldah. The seed produced locally is invariably worm-eaten before it is ripe and cannot, on this account, be utilised. This worm is known as *Chhenga* or *Senga*. The particulars about this pest are given under Ullápárá (see pp. 138—139).

Insect pest.

Labour for sowing. If labour is hired, the total expenses till the completion of sowing come to about Rs. 2 per bigha.

Harvest. The crop is ready for harvest during Magh-Falgoon (January-February). The time of harvest is indicated by the appearance of flowers and seeds. Then the whole plant is up-rooted or pulled up. A number of plants is tied in a bundle. The bundles are then steeped in water for about a week (from 5 to 7 days).

Steeping. If the soil of the field was very dry or if the crop was left, for any unavoidable reason, on the field for a longer period than necessary, the bark at the butts becomes stiff. In such cases the bundles are first placed in water erect for a day or two and then the whole

Retting. bundle is steeped in water. The process of retting the *san* fibre is similar to that of jute. One or two bundles are held by the left hand and the butt end is beaten with a piece of wood by the right hand. The fibre then becomes loose and then about 12 inches from the bottom the bundle is broken, the broken stalks pushed away. The fibre thus set free is held by the right hand, several pushings are given and the whole fibre comes out. Water is squeezed out of the bundle of fibre. The bundles of fibre are then hung up in the sun and shaken from time to time in order to

Drying. make the fibre straight until the stuff is perfectly dry.

Outturn per bigha. The quantity of the crop produced in a bigha (·33 acre) of land is from 100 to 125 bundles. In favourable circumstances the outturn is sometimes so high as 150 bundles. The amount of fibre turned out by a bigha of land is on an average 4 maunds (329 lbs.).

Value. If the average price of the fibre is taken at Rs. 6 per maund, the value of the outturn of a bigha comes to about Rs. 24 (32*s*.).

Cost of cultivation, of seed, of preparation of fibre, etc.

Cost of cultivation, seed, of preparation fibre, etc.

(1) As already stated, the cost of ploughing and sowing a bigha of land, if done by hired labour, is about Rs. 2 (2*s*. 8*d*.).

SHAHZADPUR. CULTIVATION.

(2) The quantity of seed required per bigha is ½ maund (41 lbs.) the price of which is about Rs. 4 (5*s.* 4*d.*), taking the price per maund at Rs. 8 (10*s.* 8*d.*).

(3) Assuming six men can harvest the crop of a bigha in a day, and the wages of a man annas 4 per diem, the expenses of harvesting a bigha (·33 acre) is about Rs. 1-8 (2*s.*).

Cost of cultivation, etc.

(4) The expense of carriage to the waterside for steeping cannot be ascertained exactly. It varies according to the distance of the field from the waterside. It must be remembered that *san* is grown on fields not far off from the rivers, or *bils*, so that practically this expense of carriage to the waterside is nominal. In certain cases, however, this expense may be taken at Re. 1 (1*s.* 4*d.*) per bigha (·33 acre).

(5) The cost of extracting the fibre of the crop of a bigha of land may, on an average, be taken at Rs. 2 (2*s.* 8*d.*).

(6) *Rent of the land.*—Although this cannot strictly be called a part of the cost of cultivation still we cannot neglect it, being from Rs. 1-8 to Rs. 2 (2*s.* to 2*s.* 8*d.*) per bigha (·33 acre).

Summary of cost.

All these expenses may be summarised as follows:—

	Rs.	A.	P.	
(1) Ploughing and sowing	2	0	0	per bigha.
(2) Seed	4	0	0	,,
(3) Harvesting	1	8	0	,,
(4) Carriage to waterside	1	0	0	,,
(5) Retting	2	0	0	,,
(6) Rent of the land	2	0	0	,,
(7) Sundry expenses	0	8	0	,,
Total cost	13	0	0	,,

Net profit.

As already stated, the value of the outturn of a bigha is about Rs. 24. So that the net profit left to the cultivator is approximately Rs. 11 (14*s.* 8*d.*) per bigha (·33 acre).

TRADE.

San fibre is generally sold in *hâts*, that is, weekly or bi-weekly markets. Cultivators from villages go to the nearest *hât* to sell off their stuff. *Phariahs* or petty dealers purchase the fibre and either sell again to some big dealer or export the article direct to Calcutta *viâ* Goálándo. These *Phariahs* or purchasers also go from village to village and buy the fibre from cultivators and make a

Disposal of the fibre.

SHAHZADPUR. TRADE.

higher profit in the bargain than otherwise. The greater portion of the production, it appears, is sold off in this way.

Sale at Talgachi.

In the weekly *hât* of Tálgáchi, about six miles to the north of Sháhzádpur, about 200 maunds (138 cwt. nearly) of *san* fibre are sold which are brought here for the purpose from the neighbouring villages, Mashupur, Kampur, Sarisakol, Durgádáhá, Nábábilá, Magurkolá, Silapára, Nariná, Betkandi, etc.

Commercial qualities and prices.

Three descriptions of the fibre are sold here:—

No. 1. *First quality.*—Price about Rs. 7-8 per maund (katcha weight of 60 tolas a seer). = Equivalent in pukka or standard weight of 80 tolas a seer = Rs. 10 (13*s.* 4*d.*) per maund (82·3 lbs.).

No. 2. *Medium quality.*—Price Rs. 6-8 to Rs. 7 per maund (katcha weight). = Rs. 9·4 (12*s.* 4*d.*) per maund (82·3 lbs.).

No. 3. *Inferior quality.*—Price Rs. 4-8 to Rs. 6 per maund (katcha weight). = Rs. 8 (10*s.* 8*d.*) per maund (82·3 lbs.).

Number 3 is sometimes assorted to two classes of which the worst qualities are seldom purchased for export.

Samples of these three descriptions were obtained from Tálgáchi, and their chemical examination and commercial valuations are given on pp. 141 and 142-143.

Sale at Kaijuri.

Káijuri is the biggest *san* market in the Sháhzádpur tháná. It is about seven miles to the east of Sháhzádpur and is situated on the Huráságar which dries up during the cold weather and the traffic is carried on by carts only. The goods from this place goes by cart to Sthalchar, a steamer station on the Jamuná, and thence *viâ* Goálándo to Calcutta.

Large quantities of *san* hemp are brought here for sale in the weekly market from villages lying between the Jamuná on the east and the Kakian on the west. Small quantities are also brought here in week days for sale. In the weekly *hât* some five to six hundred maunds of the fibre are sold.

Purchase by the Chittagong Company.

The most important buyer of the fibre in Káijuri is the Chittagong Company. The Company send an Agent here every year in January and make the purchase through him, till the end of April, when the *san* season is practically over. The Company have also their Agencies at Khidirkol (on the Jamuná), Sarotia (near Serájganj), Pangási and Porabári (on the Jamuná) in the Sháhzádpur tháná, and at Ullápárá and Nalka (on the Huráságar) in the Ullápárá tháná. It is stated that the total annual purchase of the Company from all their Agencies comes to about 30,000

maunds (22,044 cwt.). In Káijuri alone it is about 6,000 maunds (4,408 cwt.). *SHAHZADPUR. TRADE.*

San fibre sold in the Káijuri *hát* is assorted into four classes according to quality. It is stated that the *san* hemp produced in this locality is superior in quality to that produced in the Ullápárá tháná although the latter is the largest *san*-producing tract. This statement seems to be supported by the fact that the local prices for the different qualities of the fibre sold at Káijuri during the time of the visit were found in all cases higher by annas eight than those for their corresponding qualities sold at Ullápárá (see pp. 137 and 139-140). The commercial valuations of the fibre by the Baled Jute Association, Calcutta, and by the Imperial Institute, London, which are given at the end of this report also show that the stuffs from Káijuri carry higher values than those from Ullápárá. Sale at Kaijuri. Commercial qualities and prices.

The prevailing prices of the four classes of the *san* hemp sold in the Káijuri *hát* (by the end of March) are as follow:—

No. 1. *First quality.*—Price Rs. 8 per katcha maund (of 60 tolas a seer) = Rs. 11 (14*s.* 8*d.*) per pukka maund (of 80 tolas a seer), (82·3 lbs.)

No. 2. *Second quality.*—Price Rs. 7-8 per katcha maund = Rs. 10-8 (14*s.*) per pukka maund.

No. 3. *Third quality.*—Price Rs. 7 per katcha maund = Rs. 10 (13*s.* 4*d.*) per pukka maund.

No. 4. *Fourth quality.*—Price Rs. 6-8 per katcha maund = Rs. 8-8 (11*s.* 4*d.*) per pukka maund.

The prices at the beginning of the season, that is, during the latter part of January and in February, are generally lower than those given above and are as follow:—

	Prices at the beginning of the season, January-February, per maund, katcha weight.	Prices about the end of the season, March-April, per maund, katcha weight.
No. 1.	Rs. 7 0	Rs. 7 12 to Rs. 8 0
No. 2.	„ 6 8	„ 7 4 „ „ 7 8
No. 3.	„ 5 0 to Rs. 6 0	„ 6 12 „ „ 7 0
No. 4.	„ 4 8 „ „ 5 0	„ 6 8

Characteristics of the fibre according to which it is assorted in this *hát* are—

No. 1. Length of the fibre from six to seven feet, colour white, fibre thin and soft and strong at the same time.

Nos. 2 and 3 are assorted according to the degree of inferiority in length, colour, strength, etc., to No. 1.

SHAHZADPUR. TRADE.

If *san* is steeped in river water and especially when the water is quite pure the fibre is of good quality and is classed as No. 1 or No. 2.

Chemical examination and commercial valuations of these fibres obtained from the Káijuri *hât* are given on pp. 141 and 144-145.

Ullápárá.

ULLAPARA. CULTIVATION.

San hemp is grown largely in the Ullápárá tháná wherever water is available during the time of steeping, that is, in the months of Falgoon and Chaitra (February-March).

Extent.

The river Bural seems to be the western boundary of the *san*-producing tract in this tháná. The Bural is about 20 miles to the west of Ullápárá. It rises from the Ganges and has one branch from the Cholan *bil*. Other rivers traversing this tract are the Phuljhuri and the Muktahár. The Phuljhuri is the most important river which has its water running and is navigable all the year round for country boats. The best kind of *san* fibre is obtained from villages on its banks, *viz.*, Káliganj, Borál, Ullápárá, Sontola, Bunnyákandi, Dumduma, Rámkántapur, Sodái, Nalká, Ghurka, Poraghati, etc. The Muktahár is the other river which becomes stagnant during the cold weather. The *san* fibre of inferior quality is generally obtained from villages on its banks on account of the bad water of the river caused by continued steeping of *san*. The water becomes black and gives off such an offensive smell that one cannot pass by its banks without holding his nose. No fish can live in such waters. This is a source of malaria and had it not been for the annual inundation which carries off all these impurities the locality would have been very unhealthy.

Method of cultivation, etc.

Cultivation.—The method of cultivation, preparation of fibre, outturn, cost, profit, etc., are practically the same as detailed in the case of Sháhzádpur and is therefore unnecessary to repeat them here.

Variety.

The *Boran* is the variety grown for fibre. The *Chotna* variety is invariably grown here for green-manuring which is ploughed in, and in such fields jute or rice is grown to get a higher outturn, but preference is always given to jute as already stated. It also appears that the *Chotna* variety is grown to a large extent on the eastern side of the Phuljhuri.

Import of seed.

The seed is generally imported. Prasádpur in the Rájsháhi district seems to be the centre of supply of *san* seed to the Pábná district. It is also imported from Purnea and Maldah. Local seed

Local seed attacked by insect.

is annually attacked by an insect called *Chhenga* or *Senga* before it ripens and cannot then be utilised. However, the crop sown

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early bears fruits which are not attacked by the insect and is used to a very great extent for sowing. But the fruits of the crop sown late are always attacked by *Chhenga* which spreads over the fields and a very small amount of the seed can with difficulty be obtained which has not been worm-eaten. There is one peculiarity of the attack of *Chhenga*. As long as the plants remain in the field the insect can feed on the soft green seed, but after harvesting the crops, the seed becomes hard and the insect can no more live on it and disappears. The insect also attacks the bark of plants and damages the fibre to some extent. The seed when stored up is no more attacked by any insect. The seed is only dried in the sun and stored away in any vessel and put in the sun from time to time. It would be a great benefit to the cultivators if a remedy for this attack could be found, as the price of the imported seed is heavy.

TRADE. Markets.

Ullápárá is the biggest *san* market in the Fábná District. The other smaller markets in this tháná are Kaliganj, Boral, Nalka, Nalcha, Ghurka and Poraghati.

Dealers.

An extensive trade in the *san* fibre is carried on in the town of Ullápárá. There are about fifty dealers in the *san* hemp (they are also dealers in jute). Four or five of them carry on the business on a large scale, *viz.*, Messrs. Subal Chand Chunder & Co., the Chittagong Company, Messrs. Hem Chundra Pal & Co., and Messrs. Brijraj Balchand & Co.

Disposal of the fibre.

Almost the entire stuff purchased by these firms and other petty dealers is sent down to Calcutta, the greater portion of which is exported to Europe, only a small portion being sold to the mills in the neighbourhood of Calcutta. The Chittagong Company make the purchase through their broker and agent and send the stuff to Chandpur where it is baled and then exported *viâ* Narayangunge to Chittagong and thence to Europe.

Quantity exported.

The town of Ullápárá, including other smaller markets in this tháná, exports about 60,000 maunds of the fibre annually, Ullápárá itself exporting about 30,000 maunds.

Agricultural distinction of two classes of *san* fibre.

Two classes of *san* fibre are always distinguished as obtained from two different stages of the plant, *viz.*, the *Phulsan* and the *Ghanti san*. The plants bearing only flower give *Phulsan* and require five or six days for steeping. The plants bearing seed give *Ghanti san* and require nine or ten days in steeping. The best kind of *san* fibre is always obtained from the first.

Commercial qualities and prices.

The *san* hemp sold in Ullápárá is divided into four classes of the first, second, third and fourth qualities according to the

ULLAPARA. TRADE. Commercial qualities and prices.

assortments made in the mills. The following are the particulars of these:—

First quality.—This is *Phulsan*, that is, the *san* fibre obtained from plants harvested when flowers only have been formed. If these plants are steeped in running river water the colour, strength, softness, etc., of the fibre is excellent. This description of the fibre is of the first quality: it is white, soft, woolly to the touch, fine and strong. The length of the fibre is an additional important quality. The price of *Phulsan* is about Rs. 7-12-0 per maund of katcha weight (60 tolas = a seer), being equal to Rs.10-8 (14*s.*) in pukka weight of 80 tolas a seer or a maund of 82·3 lbs.

Second quality is slightly inferior in appearance to the first. There is a good deal of difference in fineness between the first and the second, although there is a difference of a few annas only in price. The reason is that really first quality is rarely procurable and of what passes off as first quality here a greater portion has to be sold as second quality in Calcutta. Price is about Rs. 7-8-0 per maund of katcha weight or Rs. 10-0-0 (13*s.* 4*d.*) per maund of pukka or standard weight, *i.e.*, 82·3 lbs. a maund.

Third quality is inferior to the second in every respect. Its price is from Rs. 7 to Rs. 7-4-0 per maund of katcha weight or about Rs. 9-8-0 (12*s.* 8*d.*) per maund of pukka weight, *i.e.*, 82·3 lbs. a maund.

Fourth quality.—This is slightly inferior to the third and is sold at about Rs. 6 per maund of katcha weight or Rs. 8-0-0 (10*s.* 8*d.*) per maund of pukka weight, *i.e.*, 82·3 lbs. a maund.

As stated above the fibre of the first quality is obtained from *Phulsan* only when it has been steeped in a running river water, but when the *Phulsan* has been steeped in *bíl* or stagnant water, the fibre is inferior in quality and is of the second or of the third quality according as the degree of impurity of water caused by continued steeping. The *san* fibre of the third or of the fourth quality is obtained from the *Ghanti san*, that is, the seed-bearing *san* plant.

Commercial Valuations of San Hemp from the Pábná District by Messrs. J. N. Chunder and J. Ferguson. COMMERCIAL VALUATIONS.

Samples of the fibre illustrating different qualities as sold in the markets of Ullápárá, Káijuri and Tálgáchi were procured and submitted to the Calcutta Baled Jute Association for experts' opinion. The following is the report on these samples which the Association was so kind as to obtain:—

To

The Secretary,

Calcutta Baled Jute Association.

Dear Sir,

Below we beg to give you approximate values of hemp such as submitted to you by the Officiating Reporter on Economic Products. These are based on prices which have ruled this season and which are about Re. 1 to Rs. 2 per maund higher than average of previous years. There is always a market for these kinds of hemp either by rope-makers, exporters, or fishermen for their nets. We may say that the samples which are returned herewith are rather too small to allow proper handling.

Tálgáchi	Register No.	30842	No. 1. Good, clean hemp, value Rs. 11 [14*s.* 8*d.*] per maund.
		30843	„ 2. Very poor, dirty, badly cleaned, value Rs. 6 [8*s.*] to Rs. 7 [9*s.* 4*d.*].
		30844	„ 3. Good, clean hemp, almost as good as No. 1, only fibre somewhat broken, value Rs. 10 [13*s.* 4*d.*] to Rs. 10-8 [14*s.*].
Ullápárá	„	30845	„ 1. Short fibre, fairly well cleaned, value Rs. 9-8 [12*s.* 8*d.*].
		30846	„ 2. Good clean hemp, value Rs. 10-8 [14*s.*].
		30847	„ 3. Clean, but lacks colour, value Rs. 7 [9*s.* 4*d.*].

COMMERCIAL VALUATIONS.

Káijuri . Register No.

30848	No. 1.	Good, clean hemp, value Rs. 11 [14*s.* 8*d.*].
30849	„ 2.	Quite as good as No. 1.
30850	„ 3.	Very sticky, badly handled fibre, value Rs. 7 [9*s.* 4*d.*].
30851	„ 4.	Very dirty, weak fibre. Probably would fetch Rs. 5 [6*s.* 8*d.*] to Rs. 5-8 [7*s.* 4*d.*] according to demand which very often cannot be got for such low quality.

Calcutta, 26th April 1909.

CHEMICAL EXAMINATION AND VALUATIONS.

Chemical examination and valuations in London of other samples of San Hemp from the same sources communicated by Professor Wyndham R. Dunstan.

IMPERIAL INSTITUTE.

Results of the examination of San Hemp from India.

Imperial Institute No. 28941.—Dated 17th September 1909.

Talgachi samples: No. 1.

Sample No. I from Tálgáchi, Pábná District, Eastern Bengal and Assam. Regd. No. 30842. $1\frac{3}{4}$oz.

Description.—The fibre was straw-coloured and of fair lustre, fairly well-cleaned, but somewhat towy at the ends and containing some adherent tissue.

Strength.—Fairly good.

Length of staple.—7 feet.

Commercial value.—£25 per ton (May 1909). [Rs. 13·78 per maund.]

Remarks.—With reference to this and the nine following samples, the brokers reported that the prices quoted as the current values of the fibres might be regarded as fully £4 per ton above their normal values, owing to a shortage in the supply.

CHEMICAL EXAMINATION AND VALUATIONS.

No. II from Tálgáchi, Pábná District, Eastern Bengal and Assam. Regd. No. 30843. 11¼ oz.

Talgachi samples: No. 2.

Description.—This fibre was mostly grey in colour but greenish in parts and of poor lustre. It was not very well cleaned but contained a considerable quantity of woody and other matter.

Strength.—Fairly good.

Length of staple.—4 feet.

Commercial value.—£18 per ton (May 1909). [Rs. 9·92 per maund.]

No. 3.

No. III, from Tálgáchi, Pábná District, Eastern Bengal and Assam. Regd. No. 30844. 7 oz.

Description.—The fibre was of very pale straw-colour, and of fair lustre. It was fairly well cleaned.

Strength.—Fairly good.

Length of staple.—6 feet.

Chemical Examination, see p. 145.

Commercial value.—£25 per ton (May 1909). [Rs. 13·78 per maund.]

Remarks.—In chemical composition and behaviour this sample compared favourably with the samples of *San* Hemp previously examined at the Imperial Institute (compare table at end of report, p. 145).

Ullapara samples: No. 1.

No. I from Ullápárá, Pábná District, Eastern Bengal and Assam. Regd. No. 30845. 2½ oz.

Description.—This was a very pale straw-coloured fibre, of fair lustre and slightly green in parts. It was fairly well cleaned, but contained some particles of adherent tissue, which were easily removed by gentle hackling.

Strength.—Good, but rather uneven.

Length of staple.—6 feet.

Commercial value.—£25 per ton (May 1909). [Rs. 13·78 per maund.]

No. 2.

No. II from Ullápárá, Pábná District, Eastern Bengal and Assam. Regd. No. 30846. 4¼ oz.

Description.—This fibre was of very pale straw-colour and of fair lustre. It was fairly well cleaned but contained some adherent tissue, which was easily removed on hackling.

Strength.—Good, but rather uneven.

Length of staple.—5 feet 9 inches.

CHEMICAL EXAMINATION AND VALUATIONS.

(*Chemical examination*, see opposite page).

Commercial value.—£24 per ton (May 1909). [Rs. 13·23 per maund.]

Remarks.—This fibre closely resembled No. III from Tálgáchi (Regd. No. 30844) in chemical composition and behaviour.

Ullapara samples: No. 3.

No. III from Ullápárá, Pábná District, Eastern Bengal and Assam. Regd. No. 30847. 2½ oz.

Description.—This was a pale straw-coloured fibre, slightly darker than sample No. 30846. It was fairly well cleaned, but contained some adherent tissue, easily removed by hackling.

Strength.—Good, but rather uneven.

Length of staple.—6 feet 6 inches.

Commercial value.—£23 per ton (May 1909). [Rs. 12·68 per maund.]

Kaijuri samples: No. 1.

No. I from Káijuri, Pábná District, Eastern Bengal and Assam. Regd. No. 30848. 10½ oz.

Description.—This sample consisted of very pale straw-coloured fibre of fair lustre. It was well cleaned and contained less extraneous matter than the other samples.

Strength.—Fairly good.

Length of staple.—5 feet 6 inches.

(*Chemical Examination*, see opposite page.)

Commercial value.—£27 per ton (May 1909). [Rs. 14·88 per maund.]

Remarks.—This sample closely resembled Nos. 30844 and 30846 in chemical composition and behaviour.

No. 2.

No. II from Káijuri, Pábná District, Eastern Bengal and Assam. Regd. No. 30849. Weight 8¼ oz.

Description.—This sample consisted of straw-coloured fibre, of fair lustre and fairly well cleaned, but somewhat gummy and containing some woody fragments.

Strength.—Fairly good.

Length of staple.—6 feet 6 inches.

Commercial value.—£25 per ton (May 1909). [Rs. 13·78 per maund, April 1909.]

No. 3.

No. III from Káijuri, Pábná District, Eastern Bengal and Assam. Regd. No. 30850. 11¾ oz.

Description.—This fibre was buff-coloured and of fair lustre, but was not well cleaned. It contained a large amount of woody and other extraneous matter.

CHEMICAL EXAMINATION AND VALUATIONS.

Strength.—Fair.

Length of staple.—Average 5 feet 3 inches.

Commercial value.—£20 per ton (May 1909). [Rs. 11·02 per maund.]

Kaijuri samples: No. 4.

No. IV from Káijuri, Pábná District, Eastern Bengal and Assam. Regd. No. 30851. $10\frac{1}{2}$ oz.

Description.—This fibre was grey and had little lustre. It was not well cleaned, and contained a large quantity of woody matter and tow.

Strength.—Rather weak.

Length of staple.—4 feet to 5 feet.

Commercial value.—£17 per ton (May 1909). [Rs. 9·37 per maund.]

Conclusions.

Conclusions.—The commercial experts to whom the samples were submitted confirmed the conclusions, deduced from the results of the chemical examination, that these fibres were of remarkably good quality. They were also particularly satisfactory in respect of length, strength and colour. Several of them, especially Nos. 30842, 30844, 30845 and 30848, were above the average length and were very well prepared.

The fibres represented by the present samples would find a ready market.

It may be of interest to compare the results of the three chemical examinations made in the present instance with the figures obtained for specimens of Burmese and Indian *San* Hemp previously received at the Imperial Institute.

	Registered No. 30844.	Registered No. 30846.	Registered No. 30848.	Burmese San Hemp.	Calcutta San Hemp.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture . . .	8·0	8·3	8·2	9·8	9·4
Ash	0·3	0·3	0·3	3·1	0·6
a—Hydrolysis, loss .	7·5	6·3	6·7	9·2	10·5
b—Hydrolysis, loss .	16·0	15·7	15·7	15·8	14·0
Acid purification, loss .	1·0	1·0	1·4	3·7	1·6
Cellulose . . .	87·9	88·8	87·6	87·5	90·8

CHEMICAL EXAMINATION AND VALUATIONS.

This comparison indicates that the three samples from Eastern Bengal and Assam were of very good quality and closely resembled those received from Burma and Calcutta. The present samples, however, probably contained smaller amounts of soluble extraneous impurity than the latter, since they suffered smaller loss on *a*—hydrolysis and acid purification.

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I. HENRY BURKILL,

Officiating Reporter on Economic Products to the Government of India.

ERRATA.

No. 2 (1908). Dyes from Flowers—

Page 9, line 15 from bottom, *for* Magnin de la Souce *read* Magnier de la Source.

No. 3 (1908-09). Pwe-nyet and Indian Dammars—

Page 40, last line, *for* cleo-resin *read* oleo-resin.

No. 4 (1908-09). The use of Urena lobata as a fibre material—

Page 52, line 17, delete *Kasilme.*

„ 59, „ 13 from bottom, *for* oisture *read* Moisture.

No. 5 (1908-09). The composition of Indian Rice—

Page 65, line 14, from bottom, *for* Gacong *read* Gocong.

„ 84 „ 8, „ } *for* bengali *read* bengalia.
„ 90 „ 8, „ }

„ 91 „ 2, *for* dhimdhani *read* dhundhani.

No. 6 (1908-09). Indian Pens—

Page 130, last line but one, *for* Anser sp. *read* Pavo cristatus.

„ „ last line, *for* Pavo cristatus *read* Anser sp.

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